2354

OAK RIDGE NATIONAL LABORATORY
OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION
POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37830

Internal Use Only

ORNL Ac 4
CENTRAL FILES NUMBER
71 - 8 - 3

AUG 12 1971

DATE: August 2, 1971

SUBJECT: 1970 Nuclear Safety Annual Audit

TO: Alvin M. Weinberg; F. L. Culler

FROM: Criticality Committee

ABSTRACT

As of January, 1971, the Oak Ridge National Laboratory had an inventory of approximately 3050 kg of fissile material. All of the work areas having significant quantities of fissile materials were physically inspected by members of the Criticality Committee. In general, the work areas were found to be orderly and in conformance with previous recommendations of the Committee. In a few areas it was suggested that housekeeping, signs, or procedures should be modified to increase the safety of the operations.

Criticality Committee

1970 NUCLEAR SAFETY ANNUAL REVIEW

INTRODUCTION

The responsibilities of the ORNL Criticality Committee are as follows:

a. Has review and approval jurisdiction over operations which involve the handling, storage, transportation and disposal of significant quantities of fissile materials. (R)

b. Approves a Nuclear Safety Review Request form, UCN-5917, for the existence of each fissile control area if the quantity of fissile material to exist in the area exceeds the following: (R)

   1. 200 g ^{235}U or ^{233}U or mixture thereof, but excluding the ^{235}U in items of natural or depleted uranium, or

   2. 200 g of the sum of the elements Pu, Np, Am, Cm, Bk, and Cf, or

   3. 5 g of the sum of the isotopes ^{236}Np, ^{242}Am, ^{243}Cm, ^{245}Cm, ^{247}Cm, ^{249}Cf, and ^{251}Cf

c. Reviews annually any facility or location where there is on record fissile material equal to the amount stated in (b) above.

d. Approves any new program requiring more than the above listed amounts of fissile material before the material can be withdrawn from storage.

Critical assemblies in reactor cores are the responsibility of the Reactor Operations Review Committee. However, handling of fuel elements before and after their use in a reactor and criticality problems involving experiments inserted in a reactor are to be reviewed before operators or experimenters proceed with their plans.

Our policy in performing the annual review has been that an on-site inspection is required if it is likely that the Balance Area will be charged with significant quantities of fissile materials (including other isotopes of Pu and transplutonium isotopes) in the next year. Our definition of significant considers the minimum critical mass of the material and whether materials from a balance area are likely to interact with those of another.

Our responsibilities associated with this annual review may be summarized as follows:

1. Meet the people who are charged with handling and administration of fissile materials. Provide answers to any questions that they may have and evaluate their attitudes toward nuclear safety.

2. Familiarize ourselves with work areas and processes that utilize fissile materials.

3. Determine compliance with existing Nuclear Safety Reviews (NSR's).

4. Be on the lookout for potentially unsafe conditions that might arise from poor housekeeping, cumbersome policies, inadequate administrative procedures, lack of proper signs, warnings and monitors, and possible oversights in the review-approval process.

5. Prepare a written report on the status of each Balance Area for inclusion in this annual report.

The following sections will comment on the results of the annual review (in March, 1971) by ORNL Divisions. The last section will summarize general work performed by the Committee in 1970.

The ORNL fissile inventory by Balance Area as of January 31, 1971, is presented in Table 1.

BALANCE AREA REVIEWS

Operations Division

Reviewers: R. Gwin, F. T. Binford

Balance Area	20 (C. B. Gaither)
	25 (E. M. King)
	26 (B. L. Corbett)
	200 (R. L. Newton)
	311 (R. L. Newton)
	210 (R. L. Newton)

Both the operating conditions and the general attitudes with respect to criticality control in the above areas were good. The main point of concern found in these discussions concerned the disposal of fissile materials at the burial ground and in the large waste tanks.

Chemical Technology Division

Reviewers: H. F. Stringfield and J. P. Nichols

Balance Area 72 (L. J. King)

The Balance Area has only two grams of plutonium which covers work in the hot cells of the TRU Facility. Discussion with area personnel indicates that recent processing of irradiated americium/curium materials is possibly approaching the "5 g of the sum of the isotopes ^{242m}Am, ^{243}Cm, ^{245}Cm, ^{247}Cm, ^{249}Cm, and ^{251}Cf" for which a Nuclear Safety Review would be required under Procedure 1.5, paragraph 6, Health Physics Procedures Manual. Operating personnel are checking into this.

Housekeeping practices in the area are very good and the attitude of area personnel toward nuclear safety is excellent.

OAK RIDGE NATIONAL LABORATORY

Table 1
Fissile Material Balance as of January 31, 1971
(Weights in Grams)

Balance Area	Balance Area Representative	Enriched U > 75%		Enriched U < 75%		Uranium-233		Plutonium-238		
		U	^{235}U	U	^{235}U	U	^{233}U	Pu	Pu	^{238}Pu
01	H. F. Stringfield	314,042	292,656	33,095	4,133	306	303	17,115		
12	O. J. Smith	14	13							
15	H. G. James	2,372	2,211	782	39					
20	C. B. Gaither	48,973	42,909							
25	E. M. King	308	287	303	23			67		
26	B. L. Corbett	530,737	488,419	81	2					
30	D. R. Watkins	113	105					10	1036.22	904.94
33	H. R. Gwinn	6,098	5,808	3,300	1,592	1,265	1,258	830	.22	.18
35	H. G. Hunter	983	921			146	143	246	17.98	14.29
50	G. E. Angel	3,697	3,446							
54	E. S. Bomar	436	406	180	36			531		
55	J. C. Gower	5,714	5,350	818	116	1	1	33		
57	W. W. Proaps	3,776	3,506	20,969	1,982					
58	J. D. Sease									
65	C. F. Keck	911	844	10,999	818	79	78	1,342		
70	R. E. Brooksbank	1,063,202	814,698	747	142	2,156,411	1,181,151	11,314		
72	L. J. King							2		
80	M. E. Whatley	421	389	216,976	2,571					
85	J. T. Howe	35	33					23		
90	M. F. Phillips	39	37			16	16	18		
101	Hanover Weaver	42	40			6	6	7		
102	L. B. Holland	14,967	13,949					105		
110	A. L. Harrod	373	346	4	0	26	25	116		
120	B. H. Ketelle							14		
125	C. E. Haynes	2	2	1	0			43	.93	.74
130	H. H. Abee							228	.72	.58
131	Fred Haywood	115,867	107,939					187		
135	Joe Guarneri	39	39					176		
160	Woodrow Carey	39	39	364	43			74		
165	W. W. Martin	25	23	314,183	5,751	110	108	112		
172	P. H. Harley	1	1	2,683	862	35,422	31,313	718		
	Totals	2,113,226	1,784,416	605,485	18,110	2,193,788	1,214,402	33,311	1056.07	920.73

Balance Area 80 (M. E. Whatley)

This area is charged with 2960 g of fissile material. Of this material, 389 g is 93% ^{235}U and 2571 g is in the form of 1.2% enriched fuel rods. The materials were stored and handled in accordance with NSR approvals.

The storage area was neatly arranged, housekeeping practices were good, and the attitude of area personnel toward nuclear safety is excellent.

Balance Area 65 (C. F. Keck)

This balance area is charged with 3082 g of fissile material. The materials are in use or in storage in the following locations: Room 306, Building 3019; Building 7920; Laboratories 2 and 5 in Building 3508; Building 4500; manipulator cells in Building 4505; and the Hot Storage Garden.

There are 171 g ^{239}Pu and 39 g ^{233}U in Room 306 of Building 3019. The ^{239}Pu is stored in a locked steel box mounted on the north wall of the room. The ^{233}U is stored in a glove box. The quantity of material located in this laboratory does not require an NSR according to existing procedures and regulations.

There is 310 g ^{239}Pu in use at Building 7920. In accordance with Procedure 1.5, paragraph 6, of the Health Physics Manual, an NSR should be issued for approval by the Criticality Committee. The custodian of the material (M. H. Lloyd) was requested to contact his Radiation Control Officer and the Chairman of the Criticality Committee regarding the issuance of an NSR.

Otherwise, all other materials were being used or stored in accordance with existing NSR's.

The custodian of the Hot Storage Garden indicated he would soon be requesting authorization to dispose of some of the old fuel components that are no longer needed.

Materials in Laboratories 2 and 5 of Building 3508 were static in that they were simply stored in glove boxes preparatory to bagging out waste. The custodian of Laboratory 2 (W. Pattison) advised that his work is complete except for disposal of waste, and that NSR 479 will not be renewed.

Balance Area 70 (R. E. Brooksbank)

This area (the Chemical Technology portions of Building 3019) has a fissile inventory of approximately 815 kg of ^{235}U, 1180 kg of ^{233}U, and 11 kg of plutonium. Most of this material is located in the TRUST storage tank, $^{233}U_3O_8$ dry storage wells, the ^{233}U solution storage tanks, and the storage vault (Building 3100). Operations appeared to be in strict compliance with approved Nuclear Safety Requests.

Operations in the building are presently in a transitional phase during construction of equipment for preparation of fuel for demonstration of the Light Water Breeder Reactor. Most of the work involving preparation of microspheres of plutonium and ^{235}U is expected to be phased out in 1971. It was suggested that all ^{235}U and plutonium that is not in active use be transferred to the Isotopes Division for storage or shipment off-site.

Neutron Physics Division

Reviewers: J. P. Nichols and H. F. Stringfield (March, 1971)

Balance Area 101 (H. Weaver)

The total amount of fissile material in this area is 53 g and is for use as accelerator targets. This quantity of material does not require an approved NSR under existing procedures. Each of the sources is housed in containers approved by the Radiation Control Group and the form, concentration, and spacing of the items make it unlikely that an interaction could occur. Items not in use in the accelerator are stored in two four-drawer, locked file cabinets located in a small, enclosed, concrete block repository under a stairway in the basement of Building 6010.

Area housekeeping practices are very good and proper signs, warnings, and monitors are installed.

Reviewers: J. H. Marable and J. W. Wachter

Balance Area 102 - Tower Shielding Facility (L. B. Holland)

Two NSR's were in effect:

NSR 551 - covering 524 g of ^{235}U in the form of nine clean MTR-type fuel plates spherically shaped and stored in a safe.

NSR 552 - covering 399 g of ^{235}U in the form of eight irradiated fuel plates. There appears to be no problem associated with the storage of this material.

Health Physics Division

Reviewers: J. H. Marable and J. W. Wachter

Balance Area 131 - DOSAR Facility (F. F. Haywood)

The following material was stored in a safe for which the approval could not be found and which apparently had expired:

10,878 g of ^{235}U (a 93% enrichment in U-Moly form)
91.5 g of ^{239}Pu in foils

The storage of material in the safe did not present a criticality hazard, but it was suggested that part of the safe be restricted to storage of

fissile material only and that the separations between compartments containing fissile material not be used for the storage of other material. Such restrictions should appear on the NSR when it is approved.

In addition, three Pu-Be sources were in the Balance Area:

a 4-curie source containing 64 g ^{239}Pu
a 1-curie source containing 15.7 g ^{239}Pu
a 1-curie source containing 16 g ^{239}Pu

Balance Area 130 (H. H. Abee)

Less than 230 g of Pu in the form of foils (< 5 g each) in boron balls used in 75 dosimeters distributed about the Laboratory. No criticality hazard and no on-site inspection required.

Reactor Division

Reviewers: J. H. Marable and J. W. Wachter

Balance Area 172 (P. H. Harley)

Except for a few grams of material in instrumentation, the fissile inventory of Building 7509 is located in the MSRE drain tank. Fissile materials in the tank are 31.3 kg of ^{233}U, 0.655 kg of ^{235}U, and 0.654 kg of ^{239}Pu. Mr. Harley plans to submit a new Request for Nuclear Safety Review that will cover long-term storage of all fissile materials in the building. This area was not visited in 1970.

Analytical Chemistry Division

Reviewers: J. P. Nichols and H. F. Stringfield

Balance Area 110 (A. L. Harrod)

The total amount of fissile material in this area is 512 g. Materials are in the following locations: Analytical laboratories in Buildings 7920, 3019, and 3508; Building 2026; and in Rooms C-163, D-159, and R-147 of Building 4500 South. Nuclear Safety Review Request No. 545 has been approved for this control area. Housekeeping practices at each laboratory are excellent; administrative procedures are very good; and proper signs and warnings are posted.

Instrumentation and Controls Division

Reviewers: J. P. Nichols and H. F. Stringfield (March, 1971)

Balance Area 135 (J. Guarneri)

The total amount of fissile material charged to this Balance Area is less than 200 grams. This material either does not interact with

material from other Balance Areas or is of such form and concentration that it is unlikely that these materials would appreciably increase the reactivity of other arrays of material.

Solid State Division

Reviewers: F. T. Binford and R. Gwin (March, 1971)

Balance Area 85 (J. T. Howe)

This area has less than 200 g of fissile material. The fissile materials are in small quantities and are used primarily for sources around the reactors. Only a few grams of material is not presently used and is to be returned to S. S. Accountability.

Inspection Engineering Department

Reviewers: F. T. Binford and R. Gwin (March, 1971)

Balance Area 12 (O. J. Smith)

This area routinely handles fissile materials (usually small quantities) from other balance areas and the work is often covered by Nuclear Safety Reviews requested by the customer rather than by the Inspection Engineering Department.

The new computer system for accountability of fissile materials will facilitate the control of fissile materials entering and on storage in this area.

General attitudes with respect to criticality control in this area were good.

Plant and Equipment Division

Reviewers: F. T. Binford and R. Gwin (March, 1971)

Balance Area 15 (H. G. James)
Balance Area 220 (Joe Bolinsky)

Both the operating conditions and the general attitudes with respect to criticality control in the above areas were good. The main point of concern found in these discussions concerned the disposal of fissile materials at the burial ground and in the large waste tanks.

Metals and Ceramics Division

Reviewers: D. W. Magnuson and R. E. Millspaugh

R. W. Knight, Radiation Control Officer, and H. E. Reesor maintain a file of the NSR's for the Division and have a duplicate board for visual information of the amounts of fissile material in each of the

operating areas, a smaller unit than the Balance Areas established by the Accountability Records. These materials are dispensed on a Metals and Ceramics Division form for keeping the records for each area.

Balance Area 50 (H. J. Wallace)

The inventory records had been recently verified because of the appointment of a new Balance Area Representative. No unlabeled materials were found; limits were posted for each storage cabinet inspected. All items in one safe were verified. No operations were in progress.

Balance Area 54 (E. S. Bomar)

Several kilograms of plutonium have been processed in this fuel element production laboratory leaving a net inventory of 728 g present at the time of inspection. Glove box limits and records were posted and current. The total was in agreement with the sum of the parts. Glove box operations tend to be subject to crowded conditions; however, no excessive amounts of plastic were noted as extraneous material.

Balance Area 55 (J. C. Gower)

This area is in the process of obtaining a complete and positive inventory balance prior to the appointment of a new Balance Area Representative. Much fissile material has been transferred out of the storage vault since operations were halted on September 1, 1970. The remaining material is stored in an orderly fashion with well labeled limits and actual amounts in the storage compartments. A positive inventory of 4366 g of ^{235}U having an enrichment greater than 75% ^{235}U for the vault is to be compared to a book value of 4085 g. The latter is known to contain accumulation errors of material unaccounted for but not yet corrected in the records. A reinspection was suggested at some later time when their new accounting system is operational. It is recommended that this be done no later than June 1, 1971, when all analytical samples should be complete for the positive inventory. It was suggested that the handles be removed from unused drawers where approval was granted for alternate drawer use only.

Balance Area 57 (W. W. Proaps)

The storage area for samples of material was well posted and labeled. One operation area which was limited to 500 g of ^{235}U included many different operations. Only strict administrative control by the Balance Area Representative prevents more material being dispensed and in use at one time. Another operational area in the same room for a glove box operation at intermediate enrichment is also similarly restricted. The review committee was assured that the pickling solutions from the initial cleaning of metal contained only a few grams of uranium, well below the limiting critical concentration.

Balance Area 58 (J. D. Sease)

The Interim Plutonium Laboratory has been recently put into partial operation and the present inventory of 1223 g of plutonium was verified. Posted limits were not violated and current records were posted at each glove box. Housekeeping was good. Additional glove boxes are being readied for operation in the same area. When a larger inventory of mounted metallographic samples accumulates approaching the 300 g limit for one storage shelf, the amount of associated hydrogen in the sample mounts should be investigated.

Balance Area 74 (J. M. Chandler)

The $^{233}UO_3$ powder in this area has been transferred to the burial ground in accordance with NSR 358, so no formal inspection was made.

Physics Division

Reviewers: R. E. Millspaugh and D. W. Magnuson

Balance Area 90 (M. F. Phillips)

This area has less than 20 grams of fissile material and no Nuclear Safety Reviews, so no formal inspection was made.

Chemistry Division

Reviewers: R. E. Millspaugh and D. W. Magnuson

Balance Areas 120 and 125 (B. H. Ketelle and C. E. Haynes)

These areas have less than 15 grams of fissile materials and no Nuclear Safety Reviews. The plutonium on hand is reused as a neutron filter for neutron beam experiments at HFIR. The TRL facility is aware of the possible criticality problems that may develop when large quantities of, and more information is available, about the transplutonium elements.

Reactor Chemistry Division

Reviewers: R. E. Millspaugh and D. W. Magnuson

Balance Area 160 (Woodrow Carey)

This area has less than 300 grams of fissile materials. In checking the inventory it was found that it balances with S. S. Accountability records. The location of the ^{239}Pu inventory was verified in Building 4501. Of the 70 grams in the glove boxes, 41 grams are to be removed shortly.

Balance Area 165 (W. J. Martin)

This area was checked in Building 4501 and the location of some of the fuel rods covered by NSR's 573 and 574 verified. The storage area for fissile materials in the attic was also inspected and found to be satisfactory.

Isotopes Division

Reviewers: J. W. Wachter and J. H. Marable

Balance Area 01 (H. F. Stringfield)

The warehouse areas of the Isotopes Division were found to be kept in an orderly fashion and in accordance with the approvals given by the Criticality Committee. The amount of material held in these areas is quite high, however (292 kg of ^{235}U, 17 kg of Pu), and it appears that a tighter means of control might be desirable.

A possible means of control, which was discussed at the time of the review, would make use of the Criticality Control Unit concept that is utilized for shipments. For dead storage, such as this, many more than 40 units would be allowed. This scheme is attractive because of its flexibility in providing rules for materials of different fissile materials. In addition, all outgoing or incoming shipments for Classes 1 and II already are defined in terms of the units, and all other packages can be defined in a similar manner. Certain of the existing facilities contain permanent arrays of fuel elements and the like, and these special arrays would have to be evaluated before the system would be set up. It is recommended that the feasibility of this, or a similar control method, be examined by the Isotopes Division and the Criticality Committee.

Balance Area 30 (Donna Watkins)

At the time of our review of this area, there was no active NSR on record. Relatively small amounts of material (11 g of ^{239}Pu and 115 g of ^{235}U) were stored in a well-marked locked drum in the corner of one of the buildings, together with some depleted uranium and thorium. The remaining material, 1 kg of ^{238}Pu, was stored in a cell in the three cylinders in which it had been received.

Although the material was being stored in a safe manner, it was apparent that the circumstances of receipt, handling, and storage of the material did not conform to good nuclear safety practice. It appears that the material was unexpectedly delivered directly to the working area by AEC truck without having passed through the Receiving Department and without prior notice to the recipient. The material was contained in a special shipping container, and the truck was to return the next day to pick up the empty container. The Division RCO was informed of the situation and questioned as to

the criticality aspects. He called back to say that there was "no problem." The Pu cylinders were then removed from the shipping container, plunged into a water bath to cool them, and finally removed to the present location for storage. No written Nuclear Safety approval was requested.

Under optimum conditions, the critical mass for metallic ^{238}Pu is about 10% less than that for ^{239}Pu, so that the 1-kg batch involved here is a safe mass and none of the situations described above constituted a hazard. However, it appears that in this case (as in a similar case a few years ago) the required nuclear safety precautions were abridged purely to meet the AEC truck schedule. It is recommended that supervisors be informed that they are not obliged to receive any fissile material about which they have not received prior notice and that they may not handle significant amounts of fissile material without written approval of the procedures to be carried out.

Balance Area 33 (H. R. Gwinn)

The material in this area proved to be safely handled in accordance with existing approvals. The fissile material included 1264 g of ^{233}U, 490 g of Pu, 3300 g of ^{235}U (< 75%), and 6081 g of ^{235}U (> 75%). Most of this material was in storage, although about 1500 g of ^{235}U was in process, much of it in four calutrons. The procedures being used conformed to safe practice, and a review of criticality considerations for future operations was being worked out with the Committee.

Balance Area 35 (H. G. Hunter)

Small amounts of fissile material were stored in this balance area (921 g of ^{235}U, 246 g of ^{239}Pu, and 143 g of ^{233}U) in an acceptable and approved manner.

GENERAL

New NSR Form

A new "Request for Nuclear Safety Review" form (No. UCN 5917) has been adopted in order to facilitate the preparation of information that is required by the AEC Manual Chapter 0530 and the new Nuclear Accountability Code. A copy of this form is included as Appendix A of this report.

Nuclear Accountability Code

In co-operation with the Source and Special Nuclear Materials Office, a computer program is being developed that will serve the dual purpose of nuclear materials accountability and providing those charged with nuclear criticality safety with a transient account of the location of all

fissile materials within ORNL. Discrete, nuclearly isolated locations within ORNL that are used for handling or storage of fissile materials will be designated as Control Areas that are administered by Control Area Supervisors. All transfers of fissile material within Control Areas will require the completion of a Nuclear Materials Transfer Form (Appendix B) that contains data to be made available to the machine accounting system. The bank of semipermanent data used by the code includes a Balance Area Library (Appendix C), a Library of active NSR's (Appendix D), and a Library of ORNL Control Areas (Appendix E). Typical output from the code for a single control area is shown as Appendix F.

Statistics

A total of 117 Requests for Nuclear Safety Review (NSR's 439 through 555) were processed by the Committee in 1970. Virtually all of these were approved (with recommendations), but several were withdrawn by the requesters for further study. Many of the NSR's were reviewed only by the Chairman or Subcommittees of the Committee. Two meetings of the full Committee were held.[1,2]

Jere P. Nichols, Chairman
Criticality Committee

JPN:bb

1. "Criticality Committee Meeting Held March 31, 1970," ORNL-CF-70-6-24

2. "Criticality Committee Meeting Held May 26, 1970," ORNL-CF-70-6-34

REQUEST FOR NUCLEAR SAFETY REVIEW

EXPIRATION DATE

This request covers operations with fissile material in a control area and/or fissile material transfers that originate within the control area. The control area supervisor shall complete the blocks below and describe the process and/or operations to be performed, emphasizing the provisions for nuclear criticality safety on the reverse side of this page. This request shall be approved by the Radiation Control Officers of the originating Division and the Division(s) to which fissile material will be transferred.

TITLE, CONTROL AREA, AND SUMMARY OF BASIC CONTROL PARAMETERS

(To be completed by the Control Area Supervisor)

TITLE (FOR REFERENCE PURPOSES)			DATE OF REQUEST	DATE REVIEW REQUIRED
CONTROL AREA	CODE NO.	BUILDING ROOM	DIVISION	

TYPE AND FORM OF MATERIAL		
ISOTOPIC ENRICHMENT (Wt. %)		
QUANTITY OF FISSILE ISOTOPES	PER ISOLATED BATCH OR UNIT	
	TOTAL IN CONTROL AREA	
	TOTAL TO BE PROCESSED	
Concentration or Density of Fissile Material		
Spacing of Fissile Units		
Proximity and Type of Neutron Reflectors or Adjacent Fissile Material		
Limit on Moderation		
Limit on Neutron Absorbers		
Limit on Volume Dimensions of Containers		

THIS REQUEST (MODIFIES, REPLACES) NSR(S) NO.

RECOMMENDATIONS

(To be completed by the Criticality Committee)

This endorsement is based on our present understanding of the operation (whether acquired verbally or in writing) and is subject to review and cancellation.

CHAIRMAN, CRITICALITY COMMITTEE — DATE

UCN-5917
(3 9-70)

PROVISIONS FOR NUCLEAR CRITICALITY SAFETY

(To be completed by the Control Area Supervisor)

Provisions for nuclear criticality safety shall be described below in accordance with Appendices II and III of the AEC Manual Chapter 0530. This shall include brief descriptions of the process and/or all operations to be performed, plans and procedures for the operations for nuclear criticality safety, and the basic control parameters. Please attach 11 copies of referenced drawings and documents.

EXPIRATION DATE

RADIATION CONTROL OFFICER	DIVISION	CONTROL AREA SUPERVISOR	BUILDING
RADIATION CONTROL OFFICER	DIVISION	RADIATION CONTROL OFFICER	DIVISION

Recorded by SSNM Representative
SNM-

OAK RIDGE NATIONAL LABORATORY

RECORD OF TRANSACTIONS OF SOURCE AND SPECIAL NUCLEAR MATERIALS
(Intra-ORNL Use Only)

FROM:	(1) Balance Area (1-3)	(2) Control Area (4-11)	(3) Transaction Type (12-13)	(4) Date (14-19)	TO:	(1) Balance Area (1-3)	(2) Control Area (4-11)	(3) Transaction Type (12-13)	(4) Date (14-19)
	(5) Material Status (20)	(6) NSR No. (21-24)	(7) Allotment No. (25-29)			(5) Material Status (20)	(6) NSR No. (21-24)	(7) Allotment No. (25-29)	
	Signature of Sender or Consumer-Producer		Person Responsible			Signature of Receiver		Person Responsible	

			ITEM 1	ITEM 2	ITEM 3	ITEM 4
(8) ITEM NUMBER		(30-38)				
(9) CHEMICAL OR PHYSICAL FORM		(39)				
KIND AND MASS OF SS NUCLEAR MATERIAL	(10) KIND	(40)				
	(11) MASS	(41-47)				
	(10) KIND	(48)				
	(11) MASS	(49-54)				
	(10) KIND	(55)				
	(11) MASS	(56-61)				
	(10) KIND	(62)				
	(11) MASS	(63-67)				
	(10) KIND	(68)				
	(11) MASS	(69-73)				
(12) SECURITY CLASSIFICATION		(74)				
(13) JEV NUMBER (SSNM OFFICE ONLY)		(75-79)				
SUPPLEMENTARY INFORMATION FOR SSNM RECORDS (Complete Appropriate Entries)	NUMBER OF PIECES					
	CONTAINER NUMBER					
	ANALYTICAL REPORT NUMBER					
	ASSAY REPORT NUMBER					
	GROSS WT. OF CONTAINER AND MATERIAL					
	NET WEIGHT OF MATERIAL					
	ESTIMATED LIMITS OF UNCERTAINTY	SS MASS				
		ISOTOPIC				
	Other:					

*Coding for numbered entries appears on reverse side of this form.

NOTE: SENDER-RECEIVER DIFFERENCES MUST BE REPORTED TO SS ACCOUNTABILITY OFFICE IMMEDIATELY FOR RECONCILIATION

Pertinent Comments:

TX-4342 (4-70)

CODING SYMBOLS

(1) BALANCE AREA

3 digit integer designating responsible SSNM Accountant

(2) CONTROL AREA

A discrete physical location for SSNM handling and storage.
First 4 integers are Bldg. No.
Fifth character is section or Wing No.
Last 3 integers are room number.

(3) TRANSACTION TYPE

74 Produced by nuclear transmutation
75 Loss by nuclear transmutation
90 Unaccounted loss in physical inventory
91 Unaccounted gain in physical inventory
97 Material consumed to create new item(s)
98 Material produced from previous item(s)
1T,1F Material transfer between Control Areas
2T,2F Pseudo transfer to correct records

Note: Only transaction of type 1 and 2 require completion of the "TO:" section of the form. "F" designates FROM; "T" designates TO.

(4) DATE TRANSACTION COMPLETED

e.g. 12/31/69

(5) AEC MATERIAL STATUS CODE

A Usable, stored for indefinite use
B Usable, stored for definite use
C In conversion or fabrication process
D In reactors or critical assemblies (excludes ^{6}Li, ^{238}Pu, ^{3}H)
E Pu in reactors or critical assemblies (unseparated)
F In miscellaneous research and development
G Pu in miscellaneous research and development (unseparated)
H In recovery process
I Pu in recovery process (unseparated)
J Unirradiated scrap stored for recovery
K Irradiated material in storage (excludes ^{6}Li, ^{238}Pu, ^{3}H)
L Pu-irradiated material in storage (unseparated)
M Held for account of others

(6) NUCLEAR SAFETY REVIEW NUMBER

An approved NSR number is required if the sending or receiving Control Area may contain more than 200 grams of fissile material (the sum of all ^{235}U, ^{233}U, Pu, Am, and Cm-but excluding the ^{235}U in items of natural or depleted uranium). The senders NSR normally covers the transfer. The receivers NSR normally covers work with fissile material in his Control Area.

(7) AEC PROJECT ALLOTMENT NUMBER

e.g. F-50-1 for General Research-ORNL. Codes are assigned by SSNM Office.

(8) ITEM NUMBER

Name assigned to material having characteristic isotopic composition and chemical or physical form. Leading characters are assigned by SSNM representative. Trailing zeros are replaced as new items are produced.

(9) CHEMICAL OR PHYSICAL FORM

O Ore
L Liquid
G Gas
M Metal
A Metallic alloy
F Fuel element
W Wet (hydrogenous) compound
D Dry (nonhydrogenous) compound
T Target material (e.g. Foil)
I Instrument (e.g. Fission chamber)

(10) KIND OF ISOTOPE OR ELEMENT

D Total depleted uranium
N Total normal uranium
E Total enriched uranium (including ^{233}U)
A ^{235}U
B ^{233}U (< 5 ppm ^{232}U)
C ^{233}U (5 to < 50 ppm ^{232}U)
F ^{233}U (≥ 50 ppm ^{232}U)
G Total Pu (< 5% ^{240}Pu)
H Total Pu (5 to < 7% ^{240}Pu)
I Total Pu (7 to < 10% ^{240}Pu)
J Total Pu (10 to < 13% ^{240}Pu)
K Total Pu (13 to < 20% ^{240}Pu)
L Total Pu (20 to < 25% ^{240}Pu)
M Total Pu (≥ 25% ^{240}Pu)
O Total Th
P ^{238}Pu
Q ^{237}Np
R ^{6}Li
S Total Li
T ^{3}H
U ^{2}H
V Total Am
W Total Cm

(11) MASS OF ISOTOPE OR ELEMENT

Masses are reported as integers to the nearest gram except ^{238}Pu and ^{3}H are reported to the nearest decigram.

(12) SECURITY CLASSIFICATION

Unclassified
O Official Use Only
C Confidential-Restricted Data (Group 1)
S Secret-Restricted Data (Group 1)

(13) JEV NUMBER

Assigned by the SSNM Office after the transaction data sheet has been turned in.

BALANCE AREA LIBRARY

BALANCE AREA	BALANCE AREA REPRESENTATIVE	BUILDING	BALANCE AREA TITLE
1	H F STRINGFIELD	3037	SSNM OFFICE
5	H F STRINGFIELD	3037	SSNM OFFICE - MATL ON LOAN TO ORNL SUBCONTRACTORS
12	O J SMITH	2000	INSPECTION ENGINEERING FACILITY
15	H G JAMES	3044	P&E - SPECIAL MATERIAL MACHINE SHOP
20	C B GAITHER	3042	OPERATIONS - REACTOR OPERATIONS DEPARTMENT
25	E M KING	3525	OPERATIONS - HOT CELLS OPERATING DEPARTMENT
26	B L CORBETT	7910	OPERATIONS - HIGH FLUX ISOTOPES REACTOR
30	DONNA R WATKINS	3037	ISOTOPES - RADIOISOTOPES PROCESSING DEPARTMENT
33	H R GWINN	9204-3	ISOTOPES - SPECIAL SEPARATIONS
35	H G HUNTER	3037	ISOTOPES - TARGET FABRICATION SECTION
50	H J WALLACE	3012	M&C - RESEARCH SHOP,ROLLING MILL
54	E S BOMAR	4508	M&C - INTERIM PLUTONIUM LABORATORY
55	J C GOWER	4508	M&C - GENERAL RESEARCH
57	W W PROAPS	4508	M&C - CERAMICS SECTION
58	J D SEASE	4508	M&C - REMOTE FABRICATION SECTION
60	A ZUCKER	6000	ELECTRONUCLEAR RESEARCH DIVISION
65	C F KECK	4500N	CHEM TECH - GENERAL RESEARCH
70	R E BROOKSBANK	3019	CHEM TECH - RADIOCHEMICAL PROCESSING PILOT PLANT
72	L J KING	7920	CHEM TECH - TRU FACILITY
74	J M CHANDLER	7930	M&C - TURF FACILITY
80	M E WHATLEY	4505	CHEM TECH - UNIT OPERATIONS
85	J T HOWE	3025	SOLID STATE DIVISION
90	M F PHILLIPS	4500N	PHYSICS - GENERAL RESEARCH
101	HANOVER WEAVER	6010	NEUTRON PHYSICS - GENERAL RESEARCH
102	L B HOLLAND	7702	NEUTRON PHYSICS - TOWER SHIELDING FACILITY
110	A L HARROD	4500S	ANALYTICAL CHEMISTRY LABORATORIES
120	B H KETELLE	4500N	CHEMISTRY DIVISION - GENERAL RESEARCH
130	H H ABEE	4500S	HP - APPLIED HP AND PHYSICS OF NUCLEAR RADIATION
131	F F HAYWOOD	7710	HP - RADIATION DOSIMETRY SECTION
135	JOE GUARNERI	3500	I&C DIVISION
150	WOODROW CAREY	4500S	REACTOR CHEMISTRY DIVISION
155	W J MARTIN	4501	REACTOR CHEM - NUCLEAR SAFETY EXPERIMENTS
170	L F PARSLY	7500	REACTOR DIVISION - NSPP
172	P H HARLEY	7509	REACTOR DIVISION - MSRE
200	R L NEWTON	3026	OPERATIONS - STORAGE LAGOON PIT
220	JOE BOLINSKY	7804	P&E - BURIAL GROUNDS AND SOLID WASTE STORAGE AREA
311	R L NEWTON	3026	OPERATIONS - TANK FARM CHEMICAL WASTE STORAGE

NSR LIBRARY

NSR NO.	CONTROL AREA	REQUESTOR	NSR EXPIRATION DATE	TOTAL FISSILE MASS	TITLE
51	7709HPRR	F F HAYWOOD	12/75	120000	HPRR
71	7702TSF2	L B HOLLAND	12/75	10000	TSF II
81	7702SN10	L B HOLLAND	12/75	5000	SNAP 10
1311	3005LITR	W H TABOR	5/71	9000	LITR- FUEL STG RACKS
232	7900SHIP	B L CORBETT	7/72	6800	HFIR FUEL ELEMT SHIPMT
233	7900SHIP	B L CORBETT	7/72	2600	HFIR FUEL ELEMT SHIPMT
267	7709HPRR	D R WARD	10/71	186000	SHPMT OF HPRR CORE PARTS
2801	RFD1518	R D SEAGREN	3/72	400	RFD CONTAINER MODEL 1518
2901	3001CDP	W H TABOR	3/71	9120	CANAL RACKS FOR LITR
2911	3001CCT	W H TABOR	3/71	3680	CANAL STG RACKS,CHEM TEC
295	3525CELS	R L LINES	3/71	10000	HIGH-RADIATION EXAM LAB
3071	BOE2284	B B KLIMA	5/71	1300	FOAMGLAS SHIPNG CONTAINR
3131	3008VALT	R L DONAHUE	4/71	200000	BLDG 3008 STORAGE VAULT
3141	3027VALT	R L DONAHUE	4/71	200000	BLDG 3027 STORAGE VAULT
3191	6LSSSHIP	R L DONAHUE	4/73	14000	SHIPPING CONTAINER
3251	3019TRST	J R PARROTT	7/74	1100000	TRUST FACILITY U STORAGE
330	4507CELS	J H GOODE	5/73	350	TRANSPORT OF FISS MATL
3421	PILECASK	R L LINES	6/74	1250	IN-PILE CAPSULE SHP CASK
352	3019 209	R G WYMER	11/71	300	ENRICHED UO2 SOL PREPTN
3561	3457SDCL	J A GOODE	11/71	1394	STG OF FISS MATL AT 3457
3581	7930	J M CHANDLER	11/72	300	MSRE FUEL SALT,BURIAL
3601	7702PAD	F J MUCKENTHALER	11/70	119	FISS MATL STORAGE - 7702
361	3026DSTR	A A WALLS	12/71	350	STORAGE CELL
362	3019LAB3	P A BOWMAN	12/70	1000	U233 STORAGE IN ALP LAB3
368	7900VALT	T M SIMS	1/72	538	HFIR FUEL PLATES
3711	LOOPCARR	A A WALLS	2/72	1250	LOOP TRANSPORT CARRIER
3721	7930CELB	J M CHANDLER	1/71	2000	EUTECTIC SALT STORAGE
3791	DOT 5765	B B KLIMA	5/71	210	VERM SHIPPING CONTAINER
3801	DOT5795	B B KLIMA	9/72	1580	FOAMGLAS SHIPNG CONTAINR
3811	BOE1798	B B KLIMA	2/72	350	LEAD SHIELDED CASK
388	4507CELS	J H GOODE	6/72	350	POWER FUEL WASTE DISPOSL
3901	TANKFARM	R L NEWTON	6/71	20000	LIQUID WASTE DISPOSAL
3931	TRANSHLD	W H TABOR	5/72	151	TRANSFER SHIELD
394	4508 139	J L SCOTT	6/73	1500	CERAM LAB-MATL TRANSFERS
3951	CARR NO2	B B KLIMA	5/74	350	CERTIFICATION OF CARRIER
3961	4508 106	J C GOWER	7/72	22000	M AND C STORAGE AREA
397	3019C5-7	J F PARROTT	9/71	2000	U233 DISSOLVER (CELL 5)
3981	3019PTNL	J R PARROTT	9/71	500000	U233 LIQUID STG FACILITY
3991	4507CELS	J H GOODE	7/72	350	POWER FUEL PROCESSING
4011	4505BASE	A D RYON	7/72	2568	STORAGE OF ENRICHED U
4061	4500SSTG	F J GRAY	10/71	800	METALLOGRAPHY
4091	4508PML	M M MARTIN	10/71	1000	POWDER MET LAB(117-125)
410	4508PML	M M MARTIN	10/71	300	U-AL ALCYS -ARC CASTING
420	4508 106	J C GOWER	11/71	12000	MATERIAL FOR Y12 RECOVRY
4211	EUFGND	J R GISSEL	12/71	10000	SOLID STG OPERATIONS
4221	7900POOL	B L CORBETT	2/72	9400	HFIR - STORAGE PROCEDURE
4231	4508 257	C M KROEGER	11/72	5	DIFFUSION OF U233
4241	7025ITL	E H KOBISK	12/72	3000	ISOTOPE TARGET LAB
4251	3028ITL	E H KOBISK	12/72	3000	ISOTOPE TARGET LAB
4261	3037R202	E H KOBISK	12/72	1000	LOCK-SAFE STORAGE

NSR LIBRARY

NSR NO.	CONTROL AREA	REQUESTOR	NSR EXPIRATION DATE	TOTAL FISSILE MASS	TITLE
429	4508 265	R E CLAUSING	12/71	2500	RODS -STORAGE,HANDLING
4311	3508LAB5	R H RAINEY	12/71	350	FUEL RECOVERY FLOWSHEET
4321	3508RM5N	R H RAINEY	12/71	250	SEPARATION OF TH FROM U
4361	4500SY17	B E FOSTER	1/72	750	NDT STORAGE AND HANDLING
439	3026DHOT	E M KING	1/71	1656	SHIPMENT OF UO2
442	3026CHOT	E M KING	1/73	500	STORAGE CELL
4431	UKPACKGE	R D SEAGREN	1/99	3000	UKAEA FISS PACKAGE
446	4501ABCD	M F OSBORNE	1/71	617	BURST EXPERIMENTS
447	3019LAB1	J D SEASE	2/71	400	FUEL ROD TRANSFERS
447	3019LAB2	J D SEASE	2/71	400	FUEL ROD TRANSFERS
447	3019LAB3	J D SEASE	2/71	400	FUEL ROD TRANSFERS
4501	3525CELS	E M KING	2/71	1587	EXAMINATION - HFIR ELEMT
456	4508 139	W W PROAPS	2/71	2000	MATERIAL FOR RECOVERY
458	4508 265	F J FURMAN	2/72	2100	MICROSPHERE BENEFICIATN
459	4508 139	T G GODFREY	2/71	50	MOVEMENT OF SNM
4611	4508 139	J M ROBBINS	2/72	10000	CARBON TECHNOLOGY
4621	3042SHLD	W H TABOR	3/73	250	TRANSFER SHIELD
4631	3042VALT	W H TABOR	12/71	14400	ORR FUEL RACK IN VAULT
466	4508 117	M M MARTIN	3/72	250	MOVEMENT OF FUEL PLATES
4671	7900SHIP	B L CORBETT	3/73	9400	HFIR ELEMENTS SHIPMENT
4681	4500S-S1	S S KIRSLIS	2/72	50	IPREAD CAPSULES STORAGE
4691	4500S-S2	C M BLOOD	2/72	25	FUEL ELEMENTS - STORAGE
4701	4501ABCD	G W PARKER	2/72	200	FUEL ROD BURST EXPERMTS
4711	4501 116	S H FREID	2/72	100	FUEL DESTRUCTION
4721	4501 129	C E BAMBERGER	2/72	84	FLUORIDE MELTS
474	4508 IPL	C F SANDERS	3/72	400	FUEL ROD FABRICATN TRANS
4761	3019C5-7	J R PARROTT	6/71	250000	PURIFICATION OF U233
477	3019C5-7	R W HORTON	5/71	5500	S-15 DISSOLVER
4781	4500S247	R E CLAUSING	3/72	2500	RODS - STORAGE,HANDLING
4791	3508LAB2	W L PATTISON	3/71	202	DISPOSAL OF PU SALVAGE
4801	4501CAGE	W J MARTIN	4/72	5620	BURST TESTS
4801	4501LABS	W J MARTIN	4/72	358	RUPSTS TESTS
4811	3019PHSE	R E BROOKSBANK	3/73	2000	U-233 STORAGE WELLS
4831	3042 305	W H TABOR	3/73	240	TRANSFER OF FUEL ELEMTS
485	3019CEL4	F L DALEY	5/71	10	WASTE DISPOSAL
488	3019C5-7	J R PARROTT	6/71	3250	LWBR SCRAP DISSOLVER
489	4508 139	J M LEITNAKER	1/71	200000	OXIDE PRODUCTION LINE
4901	4508 241	J D SEASE	5/71	220700	LWBR OXIDE PRODUCTION
4911	4508 254	F J FURMAN	5/71	500	RTE BLOCK LOADING
4931	3025 209	H E ROBERTSON	5/72	60	POWER CYCLING
494	3010POOL	S S HURT	5/73	200	PCA,BSR FUEL ELEMT STG
4951	4508 244	J P MOORE	5/71	25	HFIR FUEL PLATES
4961	DOT5787	B B KLIMA	12/72	350	U SHIELDED CASK DOT-5787
5001	3525RACK	E M KING	7/72	5000	HRLEL - STORAGE RACK
5021	79209,11	R G HAIRE	1/71	100	CHANGE IN PU LIMIT
5031	DOT 5828	E J MANTHOS	6/72	1000	MTR CONTANR-LIMITS CHANG
5061	4500R261	J C WILSON	6/72	75	UO2 CRYSTAL CUTTING
5081	3044SHOP	T M SIMS	1/71	9400	HFIR CRITICAL EXPERIMENT
5091	3010RACK	S S HURT	7/73	25600	FUEL STORAGE (RACK)
510	3019PTNL	R W HORTON	9/72	45000	DILUTION AND STG 233UNH

NSP LIBRARY

NSR NO.	CONTROL AREA	REQUESTOR	NSR EXPIRATION DATE	TOTAL FISSILE MASS	TITLE
511	3026DHOT	E M KING	12/70	135	BURIAL - HOT CELL SCRAPS
5121	SUGRCASK	R D SEAGREN	0/ 0	150	PU SHIPMTS SUGARMAN CASK
514	3026DHOT	E M KING	12/70	38	BURIAL - HOT CELL SCRAPS
517	4508 IPL	T G GODFREY	6/71	500	KAPL UO2 FABRICATION
518	4508 241	J M LEITNAKER	2/72	2000	OXIDE PRODUCTION LINE
519	2026	C E LAMB	11/71	210	FISSILE WASTE FROM 2026
521	BURGND	W J MARTIN	11/70	600	BURIAL U-AL ALLOY
522	3012MILL	M M MARTIN	10/72	6850	SAFE REPOSITORIES
523	3012MILL	M M MARTIN	10/72	1600	EQUIPMT-SSM IN LIQUIDS
524	3012MILL	M M MARTIN	10/72	4500	EQUIPMT -UNMODERATED SSM
5251	3012MILL	M M MARTIN	10/72	50000	CLASSIFIED MATL - RM 94
5261	3044VALT	H JAMES	10/72	27880	SPECIAL MATERIALS SHOP
527	3019PTNL	R W HORTON	11/72	900	U233 LIQUID STG FACILITY
528	4508 254	J D SEASE	12/70	859	FUEL ROD FABRICATN TRANS
5291	92043BMT	H R GWINN	10/72	15000	BASEMENT STORAGE AREA
5301	92043113	H R GWINN	10/72	10000	U STORAGE VAULT
531	4508 274	E J MANTHOS	11/70	40	ADDENDUM TO NSR 504
5331	3508 RM4	E S BOMAR	3/71	100	ELECTRO POLISHING OF PU
5351	3019 501	F L DALEY	11/72	8000	PU STORAGE
536	3525CELS	E M KING	12/70	30	BURIAL,HOT CELL SCRAP 3
541	3019C5-7	R W HORTON	12/70	1	BURIAL OF CONTAMD EQUIPT
542	4508 IPL	E S BOMAR	12/70	22000	TEMPORARY STG,U-PU ALLOY
543	4508 139	J L SCOTT	2/71	40000	MATL FOR RECOVRY,BURIAL
544	3026DHOT	E M KING	1/71	360	BURIAL-HOT CELL SCRAP 4
5451	3508LAB1	A L HARROD	12/72	3500	STG OF ANALYTICAL SAMPLE
5451	3019 AC	A L HARROD	12/72	3500	STG OF ANALYTICAL SAMPLE
5451	4500S AC	A L HARROD	12/72	3500	STG OF ANALYTICAL SAMPLE
5451	2026	A L HARROD	12/72	3500	STG OF ANALYTICAL SAMPLE
5461	9204ULAB	H R GWINN	12/71	28000	ELECTROMAGNETIC SEPNS
5471	30193100	J R PARROTT	12/72	700000	STG IN BLDG 3100 VAULT
5481	7920 209	M H LLOYD	12/70	700	PU WASTE DISPOSAL
549	2026	C E LAMB	1/71	20	FISSILE WASTE FROM 2026
5501	3025DRYS	E M KING	1/73	10000	DRY STORAGE - BLDG 3025
5511	7702SAFE	L B HOLLAND	12/72	5240	TSF-II FUEL COVER PLATES
5521	7702SILO	L B HOLLAND	12/72	4000	TSF-II FUEL PLATES
5551	450536SP	C C HAWS	4/71	35	SPHERE-FORMING LAB 36
5551	450536DY	C C HAWS	4/71	350	DRYING-FIRING LAB 36
556	3044SHOP	H G JAMES	1/72	100	NASA-LEWIS U NITRIDE PRG
5611	7900VALT	B L CORBETT	2/73	9400	HFIR FUEL STG VAULT
563	4508 139	T G GODFREY	2/72	100	MOVEMENT OF SS MAT'L
5641	3042POOL	W H TABOR	2/73	36000	ORR POOL STORAGE RACKS
5651	3C10POOL	W H TABOR	2/73	14400	BSR FUEL RACKS(ORR TYPE)
566	3042POOL	W H TABOR	2/73	1480	ORR FUEL ELEMT STG BASKT
567	3042POOL	W H TABOR	2/73	1224	ORR SHIM ROD STG RACK
5681	FUELCARR	W H TABOR	2/73	1680	ORR FUEL TRANSFR CARRIER
569	3042POOL	W H TABOR	2/73	4800	ORR GAMMA GRID STG RACK
570	4508 139	J S SCOTT	2/73	10000	MICROSPHERE EVALUATION
5711	3506VALT	H F STRINGFIELD	1/73	30000	3506- ISS STORAGE VAULT
572	4508 274	T N WASHBURN	2/72	800	CAPSULE FABRICATION
573	4501ABCD	M F OSBORNE	2/73	617	BURST TESTS

NSR LIBRARY

NSR NO.	CONTROL AREA	REQUESTOR	NSR EXPIRATION DATE	TOTAL FISSILE MASS	TITLE
574	4501ABCD	M F OSBORNE	2/73	168	BURST TESTS
575	4508 254	J D SEASE	7/71	30	HTGR CAPSULE LOADING
5751	4508 274	J D SEASE	7/71	30	HTGR CAPSULE LOADING
5761	4508 265	W B STINES	2/73	13625	STG IN ALPHA LABS 2,3
5771	7503MSRE	R H GUYMON	6/76	37000	MSRE
578	7920LABS	M H LLOYD	2/73	24	DISPOSAL OF AQUEOUS PU
579	4508 IPL	E S BOMAR	8/71	4000	(PU,U)N PELLET FABRICATN
5801	4508 IPL	C B POLLOCK	7/71	4000	COATED PARTICLE OPERATN
581	4501ABCD	W J MARTIN	7/71	145	DISPOSAL OF LIQUID WASTE
583	3019C5-7	R W HORTON	4/72	250000	THORIUM REMOVAL SYSTEM
5841	2000 39	O J SMITH	2/73	600	FUEL PIN INSPECTION
585	4508 265	W B STINES	2/73	300	TRANSFER OF FUEL PINS
587	3525CELS	E M KING	3/73	2000	HRLEL
5881	3019303A	F L DALEY	12/72	2500	PU SOLEX LAB
5891	3019 211	F L DALEY	6/72	3000	MICROSPH FACILTY
5901	3019 209	F L DALEY	6/76	850	UO2 SOL PREPN
592	3508RM5S	J T BELL	4/72	50	SOUTH SIDE GLOVE BOX
5931	3028CASK	J A SETARO	4/72	500	WASTE CASK -BLDG 3028
5941	3038ALPH	J A SETARO	4/72	1250	ALPHA HANDLING FACILITY
5951	3026DHOT	E M KING	4/73	2000	HOT CELL OPERATIONS
5961	3019 208	W R LAING	10/71	250	ANALYTICAL CHEM LAB
597	3019C5-7	R W HORTON	5/71	25000	PURIFICATUON OF U-233
5981	4500NA33	J T BELL	10/71	281	U-235,U-238 SOLUTIONS
602	92043BMT	H R GWINN	6/73	4500	ISOTOPES SEPARATIONS
603	3038ALPH	J A SETARO	6/73	1000	ALPHA HANDLING FACILITY
6051	9204-3ES	H R GWINN	6/73	250	ELECTROMAG SEPARATION
6061	92043FL2	L O LOVE	10/71	20	CALUTRON LINER BURIAL
607	92043FL2	L O LOVE	10/71	21	CALUTRN SOURCE UNIT BURL
608	92043FL2	L O LOVE	10/71	0	CALUTRN SOURCE UNIT BURL
609	92043FL2	L O LOVE	10/71	20	CALUTRN SERVICE BOX BURL

CONTROL AREA LIBRARY

CONTROL AREA	CONTROL AREA REPRESENTATIVE	ADDRESS BLDG - ROOM		CONTROL AREA TITLE	DIVISION NO.	STORAGE AREA NO.	MASTER NSP
2000 39	O J SMITH	2000	12	2000-39 FUEL PIN INSPECTN	24		584
2026	A L HARROD	4500	SM	ANAL CHEM--STG IN LABS	1		545
3001CCT	W H TABOR	3042		3001 CANAL,CHEM TECH STG	3		291
3001COP	W H TABOR	3042		3001 CANAL,LITR STG RACKS	28		290
3005LITP	W H TABOR	3042		BLDG 3005,LITR STG RACKS	28		131
3008VALT	R L DONAHUE	3008		STORAGE VAULT-BLDG 3008	25		313
3010POOL	W H TABOR	3042		3010 POOL	28		565
3010RACK	S S HURT	3010		VAULT-FUEL STORAGE RACK	28		509
3012MILL	M M MARTIN	4508		ROLLING MILL	11		525
3019 AC	A L HARROD	4500	SM	ANAL CHEM--STG IN LABS	1		545
3019 208	W R LAING	4500	S	3019-208 ANALYTL CHEM LAB	1		596
3019L501	J R PARROTT	3019		ROOM 501,OXIDE LINE	3	30193100	0
3019PHSE	J R PARROTT	3019		PENTHOUSE STORAGE WELLS	3	3019C5-7	481
3019PTNL	J R PARROTT	3019		PIPE TNL SOLN STG TANKS	3		398
3019TEST	J R PARROTT	3019		TRUST FACILITY	3		325
3019 211	J R PARROTT	3019		MICROSPHERE FACILIY RM 211	3	30193100	589
3019 209	W T MCDUFFEE	3019		BLDG 3019,RM 209	3	30193100	590
3019C5-7	J R PARROTT	3019		CELLS 5,6,7	3	3019PTNL	476
30193100	J R PARROTT	3019	110	BLDG 3100 VAULT	3		547
3019FSTG	J R PARROTT	3019	110	PU STORAGE, RM-502	3	30193100	0
3019303A	F L DALEY	3019		PU SOLEX DEVELOPMT LAB	3	30193100	588
3595JEZ	J R PARROTT	3019	110	JEZEBEL STORAGE WELL	3		0
3025 209	H E ROBERTSON	3025		BLDG 3025,RM EL-209	14		493
3025DRYS	R L LINES	3025		3025,DRY STORAGE	28		550
3026DHOT	E M KING	3026	D	HOT CELL OPERATNS, STG CEL	28		595
3027VALT	R L DONAHUE	3027		BLDG 3027,STORAGE VAULT	25		314
3028ITL	E H KOBISK	3037		ISOTOPE TARGET LABS	25		425
3028CASK	J A SETARO	3037		WASTE CASK - BLDG 3028	25		593
3037P202	E H KOBISK	3037		LOCK-SAFE STORAGE	25		426
3038ALPH	J A SETARO	3037		ALPHA HANDLING FACILITY	25		594
3042 305	W H TABOR	3042		3042,ROOM 305	28		483
3042SHLD	W H TABOR	3042		LITR TRANSFER SHIELD	28		462
3042VALT	W H TABOR	3042		ORR FUEL ELEMENT IN VAULT	28		463
3042POOL	W H TABOR	3042		3042,POOL	28		564
3044SHOP	T M SIMS	3044		SPECIAL MATL MACHINE SHOP	21		508
3044VALT	H J JAMES	3044		3044,SS VAULT	21		526
3457GDCL	J H GOODE	4500	N	3457 - STG GARDEN,CANAL	3		356
3506VALT	H F STRINGFIELD	3037		3506 ISS STORAGE VAULT	25		571
3508LAB1	A L HARROD	4500	SM	ANAL CHEM--STG IN LABS	1		545
3508 RM4	E S BOMAR	3508		BLDG 3508,RM 4	1		533
3508RMEN	R H RAINEY	3508		BLDG 3508 - ROOM 5	3		432
3508LAB5	R H RAINEY	3508		BLDG 3508 - ALPHA LAB 5	3		431
3508LAB2	W L PATTISON	3508		BLDG 3508 - LAB 2	3		479
3525RACK	E M KING	3525		STORAGE RACK,PRLEL	28		500
3525CELS	E M KING	3525		HOT CELLS	28		450
4500NA33	J T BELL	4500	A-33	4500N LAB A-33 SW HOOD	3		598
4500S AC	A L HARROD	4500	SM	ANAL CHEM--STG IN LABS	1		545
4500SY17	B E FOSTER	4500	S	BLDG 4500S,RM Y17,CABINET	11		436
4500SSTG	R J GRAY	4500	S	4500S STORAGE	11		406
4500S-S2	C M BLOOD	4500	S	LOCKED SAFE-RM R227,4500S	14		469

CONTROL AREA LIBRARY

CONTROL AREA	CONTROL AREA REPRESENTATIVE	ADDRESS BLDG - ROOM		CONTROL AREA TITLE	DIVISION NO.	STORAGE AREA NO.	MASTER NSR
4500S-S1	S S KIRSLIS	4500	S	LOCKED SAFE-RM E260,4500S	14		468
4500R261	J C WILSON	4500	S	4500S,ROOM R261	11		506
4500S247	R E CLAUSING	4500	S	4500S,ROOM B247	11		478
4501 116	S H FREID	4501		FIREPROOF CABINET - RM 116	14		471
4501 129	C E BAMBERGER	4501		BLDG 4501,RM129 GLOVE BOX	14		472
4501ABCD	M E OSBORNE	4501		BLDG 4501,RM103,HOT CELLS	14		470
4501LABS	W J MARTIN	4501		RMS 103,124,125	14		480
4501CAGE	W J MARTIN	4501		4501,THIRD FLOOR CAGE AREA	14		480
4505BASE	A D RYON	4505		BASEMENT OF 4505-STORAGE	3		401
4507CELS	J H GOODE	4500	N	4507 CELLS	3		399
4508 265	R E CLAUSING	4508		ROOM 265	11		576
4508 257	D M KROEGER	4508		BLDG 4508,RM 257	11		423
4508 106	J C GOWER	4508		BLDG 4508,106 CAGE ROOM	11		396
4508PML	M M MARTIN	4508		POWDER METALLURGY LAB	11		409
4508 241	J M LEITNAKER	4508		ROOM 241	11		490
4508 IPL	T G GODFREY	4508		RM 136,137--PU LAB	11		580
4508 244	J P MOORE	4508		PHYSICAL PROPERTY LAB	11		495
4508 254	F J FURMAN	4508		BLDG 4508,ROOM 254	11		491
4508 274	A R OLSEN	4508		BLDG 4508,ROOM 274	11		575
4508 139	T G GODFREY	4508		4508,RM 139,139C	11		461
7025ITL	E H KOBISK	3037		ISOTOPE TARGET LABS	25		424
7503MSRE	S H GUYMON	7503		MSRE	16		577
7702SAFE	L B HOLLAND	7702		SECURITY SAFE,RAMP HALLWAY	12		551
7702PAD	L B HOLLAND	7702		TOWER PAD AREA	12		360
7702SILO	L B HOLLAND	7702		SILO STORAGE AREA	12		552
7702TSF2	L B HOLLAND	7702		TSF II REACTOR	12		7
7702SM10	L B HOLLAND	7702		SNAP 10 REACTOR	12		8
7709HPRR	F F HAYWOOD	7710		HPRR REACTOR	12		5
7900VALT	R L CORBETT	7910		HFIR- FUEL STG VAULT	28		561
7900POOL	B L CORBETT	7910		HFIR- STG POOLS	28		422
7900SHIP	R L CORBETT	7910		HFIR - ROUTINE SHIPMENTS	28		467
79209,11	R G HAIRE	7920		7920,ROOMS 109,211	3		502
7920 209	M H LLOYD	7920		BLDG 7920,RM 209	3		548
7930CELB	J M CHANDLER	7930		7930,CELL B	11		372
7930	J M CHANDLER	7930		BURIAL GROUND	11		358
92043FL2	L G LOVE	9204	-3	2ND FLOOR,RAD CONTAINMENT	25		606
92043BMT	H R GWINN	9204	-3	BASEMENT - BLDG 9204-3	25		529
92043113	H R GWINN	9204	-3	BLDG 9204-3,113 STG VAULT	25		530
9204ULAB	H R GWINN	9204	-3	2ND FLOOR WASH AREA,U LAB	25		546
9204-3EFS	H R GWINN	9204	-3	ELECTROMAGNETIC SEPARATION	25		605
TANKFARM	R L NEWTON	3042		TANK FARM AREA	28		390
BURGND	J R GISSEL	7002		BURIAL GROUND	21		421
PILECASK	R L LINES	3525	109	IN-PILE CAPSULE SHIP CASK	28		342
DOT 5765	B B KLIMA	4500		VERMICULT SHIPNG CONTAINER	3		379
DOT5767	B B KLIMA	4500		URANIUM SHIELDED CASK D-38	3		496
BOE2284	B B KLIMA	4500		FOAMGLAS CONTAINR,B E 2284	3		307
CARR NO2	B B KLIMA	4500		GARDEN CARRIER NO. 2	3		395
BOE1798	B B KLIMA	4500		LEAD SHIELD CASK,B E 1798	3		381
DOT5795	B B KLIMA	4500		FOAMGLAS CONTAINR,DOT 5795	3		380
DOT 5828	F J MANTHOS	4508		MTR SHIM ROD SHIPG CONTANR	11		503

CONTROL AREA LIBRARY

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6LSSSHIP	R L DONAHUE	3037	6L SS SHIPPING CONTAINER	25		319
SUGRCASK	R D SEAGREN	3047	SUGARMAN CASK	25		512
UKPACKGE	R D SEAGREN	3047	UKAEA FISSILE PACKAGE	25		443
RFD1518	R D SEAGREN	3047	RFD CONTAINER,MODEL 1518	25		280
TRANSHLD	W H TABOR	3042	3001-300F,TRNASFER SHIELD	28		393
FUELCARR	W H TABOR	3042	ORR FUEL TRANSFER CARRIER	28		568
LOOPCARR	A A WALLS	3026	TRANSPORT CARRIER	28		371

FISSILE MATERIAL BALANCE - CONTROL AREA 3019PHSE - CONTROL AREA REPRESENTATIVE J R PARROTT BLDG 3019 4/29/71

TRANSACTIONS (TRANSFERS AND CONSUMPTION AND PRODUCTION OF ITEMS) IN LAST 40 DAYS

DATE OF TRANSCT	TYPE CODE	ITEM NUMBER	TRANS INFO	CONTROL AREA	BALANCE AREA	JEV NO.	NSR NO.	* MASS OF FISSILE AND FERTILE MATERIALS (GRAMS) * U-235	U-233	PU	U	TH	PU-238	AM-CM	FISSILE MASS TOTAL	FISSILE MASS SAFE
5/28/71	1T	SNM122670	TO	3019C5-7	70		476	0.	0.	0.	10600.	0.	0.	0.	0.	200.
5/28/71	1T	SNM122940	TO	3019C5-7	70		476	46.	0.	0.	49.	0.	0.	0.	46.	351.

NUCLEAR MATERIALS INVENTORY AS OF 4/29/71

ITEM	BALANCE AREA	CHEMICAL PHYSICAL FORM	MATL STATUS CODE	PROJECT ALLOTMENT NUMBER	* MASS OF FISSILE AND FERTILE MATERIALS (GRAMS) * U-235	U-233	PU	U	TH	PU-238	AM-CM	FISSILE MASS TOTAL	FISSILE MASS SAFE
SNM122670	70	METAL	A	F50 1	0.	0.	0.	10000.	0.	0.	0.	0.	200.
TSF210000	70	ORE	A	F50 1	189.	0.	0.	205.	0.	0.	0.	189.	351.
TOTALS					189.	0.	0.	10205.	0.	0.	0.	189.	551.

2354

OAK RIDGE NATIONAL LABORATORY
OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION
POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37830

Internal Use Only

ORNL
CENTRAL FILES NUMBER
74-3-19

DATE: March 21, 1974

SUBJECT: 1973 Nuclear Safety Annual Review

TO: H. Postma; F. L. Culler

FROM: Criticality Committee

ABSTRACT

As of August, 1973, the Oak Ridge National Laboratory had an inventory of approximately 3016 kg of fissile material. All of the work areas having significant quantities of fissile materials were physically inspected by members of the Criticality Committee. In general, the work areas were found to be orderly and in conformance with previous recommendations of the Committee. In a few areas it was suggested that housekeeping, signs, or procedures, should be modified to increase the safety of the operations.

1973 NUCLEAR SAFETY ANNUAL REVIEW

INTRODUCTION

The responsibilities of the ORNL Criticality Committee are as follows:

a. Has review and approval jurisdiction over operations which involve the handling, storage, transportation, and disposal of significant quantities of fissile materials.

b. Approves a Nuclear Safety Review Request form, UCN-5917, for the existence of each fissile control area if the quantity of fissile material to exist in the area exceeds the following:

   1. 200 g ^{235}U or ^{233}U or mixture thereof, but excluding the ^{235}U in items of natural or depleted uranium, or

   2. 200 g of the sum of the elements Pu, Np, Am, Cm, Bk, and Cf, or

   3. 5 g of the sum of the isotopes ^{236}Np, ^{242m}Am, ^{243}Cm, ^{245}Cm, ^{247}Cm, ^{249}Cm, and ^{251}Cf

c. Reviews annually any facility or location where there is on record fissile material equal to the amount stated in (b) above.

d. Approves any new program requiring more than the above listed amounts of fissile material before the material can be withdrawn from storage.

Critical assemblies in reactor cores are the responsibility of the Reactor Operations Review Committee. However, handling of fuel elements before and after their use in a reactor and criticality problems involving experiments inserted in a reactor are to be reviewed before operators or experimenters proceed with their plans.

Our policy in performing the annual review has been that an on-site inspection is required if it is likely that the Balance Area will be charged with significant quantities of fissile materials (including other isotopes of Pu and transplutonium isotopes) in the next year. Our definition of significant considers the minimum critical mass of the material and whether materials from a balance area are likely to interact with those of another.

Our responsibilities associated with this annual review may be summarized as follows:

1. Meet the people who are charged with handling and administration of fissile materials. Provide answers to any questions that they may have and evaluate their attitudes toward nuclear safety.

2. Familiarize ourselves with work areas and processes that utilize fissile materials.

3. Determine compliance with existing Nuclear Safety Reviews (NSRs).

4. Be on the lookout for potentially unsafe conditions that might arise from poor housekeeping, cumbersome policies, inadequate administrative procedures, lack of proper signs, warnings, and monitors, and possible oversights in the review-approval processes.

5. Prepare a written report on the status of each Balance Area for inclusion in this annual report.

The following sections will comment on the results of the annual review (in December, 1973) by ORNL Divisions. The last section will summarize general work performed by the Committee in 1973.

The ORNL fissile inventory by Balance Area as of August 31, 1973, is presented in Table 1.

Table 1

FISSILE MATERIAL BALANCES AS OF AUGUST 31, 1974
(Weights in Grams)

Balance Area and Representative	Enriched Uranium		Uranium-233		Plutonium		Plutonium-238	
	U	^{235}U	U	^{233}U	Pu	^{239}Pu ^{241}Pu	Pu	^{238}Pu
01 H. F. Stringfield	525,063	236,970	4,067	3,987	12,055	9,883	686.2	567.2
12 O. J. Smith								
15 J. W. Jackson	7,704	7,098						
20 C. B. Gaither	89,913	74,840			11	10		
25 E. M. King	1,226	746	512	45	152	141		
26 B. L. Corbett	580,720	532,263						
30 D. R. Watkins	20	17			498	465	765.6	662.9
33 H. R. Gwinn	1,571	939	361	359	2,717	919		
35 H. L. Adair	2,308	2,170	68	68	333	320	17.7	14.1
50 G. E. Angel	12,445	11,595						
54 E. S. Bomar	21	19	614	597	197	177		
55 V. R. Bullington	345	97	1	1				
57 W. W. Proaps	9,293	3,302						
58 J. D. Sease	504	434	7	7	106	94		
65 C. F. Keck	12,397	2,157	39	13	762	722		
70 R. E. Brooksbank	1,049,175	801,614	2,113,842	1,139,423	2,625	2,344		
72 E. D. Collins					1	*		
75 F. A. Kappelmann					289	245		
80 A. D. Ryon	388	360						
85 J. T. Howe	20	19			23	23		
90 M. F. Phillips	41	38	17	17	36	27		
101 Hanover Weaver	40	40	6	6	2	2		
102 L. B. Holland	10,003	9,317			6	6		
110 A. L. Harrod	6	6			82	77		
120 B. H. Kettelle					14	13		
125 C. E. Haynes	2	*			82	28	1.4	1.1
130 A. D. Warden					227	225	0.7	0.6
131 F. F. Haywood	144,453	134,567			205	203		
135 W. P. Kinser	32	31			176	174		
165 W. W. Martin	82,379	2,299	110	108	121	111		
172 P. H. Harley	2,684	863	35,387	31,283	718	646		
Totals	2,526,753	1,821,801	2,155,031	1,175,914	21,438	16,855	1,471.6	1,245.9

*Less than 0.5 g

BALANCE AREA REVIEWS

Operations Division

Reviewers: R. E. Millspaugh and J. W. Wachter

Balance Area 20 (C. B. Gaither)

Both the vault and pool storage facilities for BSR, PCA, ORR, and Building 3001 were visited on November 12, 1973. The storage racks in both the BSR and ORR vaults were filled with fuel elements and plates in compliance with the posted regulations.

The AEC is storing some shipping containers in Building 3095. These were also checked and found to be satisfactory.

Balance Area 25 (E. M. King)

This area was reviewed on November 9, 1973, and the Building 3026D storage cell checked. Less than 1 kg of fissile materials is divided between Buildings 3025, 3026, and 3525 in small quantities. The storage cell in 3026D, which contains a larger amount of fissile material, was found to be satisfactory. Much of the work where fissile materials are handled is declining.

Balance Area 26 (B. L. Corbett)

This area handles and stores new and spent HFIR fuel elements in a storage vault and pool. The accountability boards were checked in B. L. Corbett's office, and the storage vault in HFIR visited on November 12. Everything was found to be in order. The amount of fissile ^{235}U material in the vault had increased an additional 78,107 grams since September 30, 1973, to a total of 501,441 grams. All of the operations are routine and are handled in strict accordance with the NSRs.

Balance Area 311 (R. L. Newton)

This area covers the liquid waste disposal system at the tank farm which has been operated in accordance with the Standard Operating Procedures. Large quantities of solutions poured into the waste system are diluted with ^{238}U or ^{232}Th as noted on the SF forms received by the Operations Division. R. L. Newton reports that no changes have been made since the last operation.

Metals and Ceramics Division

Reviewers: H. C. Austin, J. H. Marable

Balance Area 50 (G. E. Angel)

At this time there is no active work with fissile materials in the Rolling Mill, Building 3012. The inventory of ^{235}U, consisting of fuel plates, core punchings, etc., is stored in conformance with approved NSRs.

Balance Area 54 (E. S. Bomar)

Fissile materials are within the Interim Plutonium Laboratory, rooms 136 and 137 of Building 4508. Glove boxes and/or suites of boxes, with one exception, were clearly marked with a sign showing the limit of not more than 250 grams of fissile material per box or suite. A sign will be made and attached to the unmarked box.

Housekeeping in the area was good and operations are performed in accordance with approved NSRs.

Balance Area 55 (V. R. Bullington)

The fissile material storage cage on the balcony of room 106 contains no fissile material at this time. The laboratories under this balance area, which contain only small quantities of materials, were not visited during this audit.

Balance Area 57 (W. W. Proaps)

Most of the materials in this area are stored in an orderly fashion in filing cabinets with adequate labeling and accounting. Processing and storage operations conform to approved NSR. Good administrative control is exercised to insure that the approved limits for fissile materials are not exceeded.

Balance Area 58 (J. D. Sease)

The Alpha Facility in Building 4508 is inactive at this time and materials are in temporary storage within hoods. The inventory is being evaluated for either recovery or disposal.

SOLID STATE DIVISION

Reviewers: J. W. Wachter and R. E. Millspaugh

Balance Area 85 (J. T. Howe)

Since only 6 grams of enriched ^{235}U were present in the area at the time of the audit, no NSR was required. No additional use of fissile material is expected in the future.

INSPECTION ENGINEERING DEPARTMENT

Reviewers: J. W. Wachter and R. E. Millspaugh

Balance Area 12 (O. J. Smith)

Work involving fissile material in this balance area is normally limited to a few grams of fissile material and is covered by a joint NSR with other

divisions. No fissile material was charged to the balance area, no NSRs were active, and no activity involving fissile material anticipated.

PLANT AND EQUIPMENT DIVISION

Reviewers: J. W. Wachter and R. E. Millspaugh

Balance Area 15 (J. W. Jackson)

At the time of the audit, 2,757 g of ^{235}U were charged to the balance area in the form of shim rods. Eighteen of these were being processed in the Special Materials Machine Shop and the remaining units were in the Building 3027 vault. Operations were orderly and in conformance with the applicable NSRs.

CHEMICAL TECHNOLOGY DIVISION

Reviewers: D. W. Magnuson and R. Gwin

Balance Area 70 (R. E. Brooksbank)
Balance Area 65 (D. E. Horner)
Balance Area 80 (A. D. Ryon)
Balance Area 72 (E. D. Collins)
Balance Area 75 (F. A. Kappelmann)

A review of the operations in the balance areas listed above involving fissile materials has been made. The knowledge and attitude of those in charge of the particular operation are very good. Compliance with the pertinent NSRs was observed in all cases.

With regard to sampling Gd/U and Cd/U ratios in the large tank (NSR 325), it is suggested that for a few trial duplicate samples be sent to different laboratories for analysis.

The material balance as maintained in the control area and as listed by the sheets distributed for the review (Fissile Material Balance as of 9/30/73) did not always correspond. This method of auditing material flow could be of great value in nuclear safety; at present this does not seem to be the case.

A continuing effort should be made to upgrade the quality of the NSRs. Some are almost useless except in the fact that some fissile material is being processed or stored and need more details than just so stating.

NEUTRON PHYSICS DIVISION

Reviewers: F. T. Binford and J. P. Nichols

Balance Area 102 (L. B. Holland)

Virtually all of the stored fissile material in this Division is located at the Tower Shielding Facility (Building 7700) and is in the form of

metal reactor parts which are stored in an approved manner in the Air Force safe or in the concrete storage wall.

Balance Area 101 (H. Weaver)

Approximately 60 grams of fissile research material (including 18 g of Pu)is in use in Building 6010. In all cases, the material is being handled according to approved safety procedures.

ISOTOPES DIVISION

Reviewers: F. T. Binford and J. P. Nichols

Balance Area 01 (H. F. Stringfield)
Balance Area 30 (D. R. Watkins)
Balance Area 33 (H. R. Gwinn)
Balance Area 35 (H. L. Adair)

Significant quantities of fissile material are stored in an approved vault (Building 3027). A second vault (Building 3008) is no longer used for the storage of enriched material. All of the material stored in Building 3027 is in approved containers and is being handled according to standard safety procedures.

Transuranium isotopes are stored in hot cells and glove boxes in Building 3038, and also in an approved shielded container. These materials are generally "in process."

A cabinet on the second floor of Building 3028 is used for storing plutonium and curium isotopes. NSR 676 provides for a limit of 4 Kg of fissile material stored in approved isotope containers. The committee believes that this approval should be modified to include an additional limit on the amount of fissile material permitted in each individual container and a limit on the amount of moderator permitted in the cabinet. We further suggest that this cabinet be replaced by a safe or some other more secure type of storage facility.

HEALTH PHYSICS DIVISION

Reviewers: F. T. Binford and J. P. Nichols

Balance Area 131 (F. F. Haywood)

The fissile inventory in this Division is located almost exclusively at the DOSAR facility (Building 7709). It is in the form of reactor parts and is stored in an approved fashion.

REACTOR CHEMISTRY DIVISION

Reviewers: F. T. Binford and J. P. Nichols

Balance Area 165 (W. J. Martin)

This Division no longer exists; however, four NSRs 649, 650, 651, and 681 are all still active. These all have reference to the storage of power reactor fuel which is with the exception of 24 grams of 98% enriched ^{235}U and 189 g of ^{233}U low enriched material. Some of the material has been irradiated and is stored in shielded containers. The responsible investigator, G. W. Parker, wishes to retain this material for further work.

ANALYTICAL CHEMISTRY DIVISION

Reviewers: R. Gwin and D. W. Magnuson

Balance Area 110 (Arnold Harrod)

Less than 200 grams of enriched U or Pu in this area. No NSR required.

INSTRUMENTATION AND CONTROLS DIVISION

Balance Area 135 (W. P. Kinser)

Less than 200 grams of enriched U or Pu in this area. No NSR required.

CHEMISTRY DIVISION

Reviewers: J. H. Marable and H. C. Austin

Balance Area 125 (C. E. Haynes)
Balance Area 120 (B. H. Ketelle)

Each of these areas has less than 200 g of fissile material. No NSR required.

PHYSICS DIVISION

Reviewers: J. H. Marable and H. C. Austin

Balance Area 90 (M. F. Phillips)

This area has less than 200 g of fissile material. No NSR required.

REACTOR DIVISION

Reviewers: J. H. Marable, H. C. Austin

Balance Area 172 (H. Stringfield)

The fissile materials listed for this area are stored in the MSRE drain tanks.

GENERAL

SSNM Accounting System

The machine accountability system is now in operation. The primary function is to account for all nuclear materials by physical location. It also analyzes each transaction for criticality considerations. To date the accounting information has been very accurate, however, the accuracy can be no better than the data input and the human error is a problem which requires constant attention.

Statistics

A total of 47 Requests for Nuclear Safety Review (NSRs 673 through 720) were processed by the Committee in 1973. Virtually all of these were approved (with recommendations), but several were withdrawn by the requesters for further study. Approval (by memo) was given to extend expiration dates on several NSRs where no (or inconsequential) changes in operation were anticipated.

Jere P. Nichols, Chairman
Criticality Committee

JPN:bb

2354

OAK RIDGE NATIONAL LABORATORY
OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION
POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37830

DATE: January 22, 1973

SUBJECT: 1972 Nuclear Safety Annual Review

TO: A. M. Weinberg; F. L. Culler

FROM: Criticality Committee

ABSTRACT

As of November, 1972, the Oak Ridge National Laboratory had an inventory of approximately 2900 kg of fissile material. All of the work areas having significant quantities of fissile materials were physically inspected by members of the Criticality Committee. In general, the work areas were found to be orderly and in conformance with previous recommendations of the Committee. In a few areas it was suggested that housekeeping, signs, or procedures, should be modified to increase the safety of the operations.

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   2. 200 g of the sum of the elements Pu, Np, Am, Cm, Bk, and Cf, or

   3. 5 g of the sum of the isotopes ^{236}Np, ^{242m}Am, ^{243}Cm, ^{245}Cm, ^{247}Cm, ^{249}Cf, and ^{251}Cf

c. Reviews annually any facility or location where there is on record fissile material equal to the amounted stated in (b) above.

d. Approves any new program requiring more than the above listed amounts of fissile material before the material can be withdrawn from storage.

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Our policy in performing the annual review has been that an on-site inspection is required if it is likely that the Balance Area will be charged with significant quantities of fissile materials (including other isotopes of Pu and transplutonium isotopes) in the next year. Our definition of significant considers the minimum critical mass of the material and whether materials from a balance area are likely to interact with those of another.

Our responsibilities associated with this annual review may be summarized as follows:

1. Meet the people who are charged with handling and administration of fissile materials. Provide answers to any questions that they may have and evaluate their attitudes toward nuclear safety.

2. Familiarize ourselves with work areas and processes that utilize fissile materials.

3. Determine compliance with existing Nuclear Safety Reviews (NSRs).

4. Be on the lookout for potentially unsafe conditions that might arise from poor housekeeping, cumbersome policies, inadequate administrative procedures, lack of proper signs, warnings, and monitors, and possible oversights in the review-approval processes.

5. Prepare a written report on the status of each Balance Area for inclusion in this annual report.

The following sections will comment on the results of the annual review (in December, 1972) by ORNL Divisions. The last section will summarize general work performed by the Committee in 1972.

The ORNL fissile inventory by Balance Area as of October 31, 1972, is presented in Table 1.

Table 1. FISSILE MATERIAL BALANCES AS OF OCTOBER 31, 1972
(Weights in Grams)

Balance Area and Representative		Enriched Uranium		Uranium-233		Plutonium		Plutonium-238	
		U	^{235}U	U	^{233}U	Pu	$^{239\ 241}Pu$	Pu	^{238}Pu
01	H. F. Stringfield	263,220	235,290	210	208	10,483	8,442	722.7	579.1
12	O. J. Smith								
15	R. S. Jones	4,135	3,557						
20	C. B. Gaither	59,299	52,036			11	10		
25	E. M. King	1,152	681	203	43	171	159	0.5	0.1
26	B. L. Corbett	439,981	403,743						
30	D. R. Watkins	21	17			10	10	1,020.4	907.2
33	H. R. Gwinn	1,700	1,062	362	360	1,981	965		
35	H. L. Adair	2,238	2,108	196	193	310	303	17.8	14.2
50	G. E. Angel	3,619	3,373						
54	E. S. Bomar	133	123	428	418	818	744		
55	V. R. Bullington	1,983	1,004	1	1	10	9		
57	W. W. Proaps	23,526	4,250						
58	J. D. Sease	5,286	4,292	51	49	1,865	1,698		
65	C. F. Keck	12,375	2,105	49	47	1,490	1,363		
70	R. E. Brooksbank	1,049,131	801,572	2,156,857	1,181,615	2,407	2,142		
72	E. D. Collins					21	*		
80	M. E. Whatley	218,424	3,751						
85	J. T. Howe	20	19			23	23		
90	M. F. Phillips	41	38	17	17	24	16		
101	Hanover Weaver	40	40	6	6	5	5		
102	L. B. Holland	14,967	13,949			6	6		
110	A. L. Harrod	71	50			83	78		
120	B. H. Ketelle					14	13		
125	C. E. Haynes	2	*			32	28	1.4	1.1
130	A. D. Warden					227	225	0.7	0.6
131	F. F. Haywood	115,867	107,939			205	203		
135	W. P. Kinser	26	25			176	174		
160	Woodrow Carey	99	94			30	27		
165	W. W. Martin	266,136	5,003	110	108	91	84		
172	P. H. Harley	2,684	863	35,387	31,283	718	646		
	TOTALS	2,486,176	1,646,984	2,193,877	1,214,348	21,211	17,343	1,763.5	1,502.3

*Less than 0.5 g

BALANCE AREA REVIEWS

Inspection Engineering Department

Reviewers: J. P. Nichols and J. H. Marable

Balance Area 12 (O. J. Smith)

This Balance Area, which includes all of the work performed by the Inspection Engineering Department in Building 2000, normally contains quantities of fissile material that are well below the limits that require a Nuclear Safety Review. It is not likely that fissile materials of this Balance Area will interact with those of another Balance Area. Operations in which significant quantities of fissile material are handled are co-ordinated with customer divisions and handled with a joint NSR.

Plant and Equipment Division

Reviewers: J. P. Nichols and J. H. Marable

Balance Area 15 (Ross Jones)

This Balance Area is the Special Nuclear Materials Machine Shop. The fissile inventory at the time of review consisted of three segments of TSR fuel (1200 g fissile) and five stacks of ORR fuel plates (1200 g fissile). Operations were orderly and in conformance with the existing NSRs.

Through approximately July, 1973, a total of 100 ORR elements (each containing 240 g ^{235}U) and 24 ORR fuel rod assembly sections (each containing 138 g ^{235}U) will be fabricated by reworking 90 AF-NETR elements and 20 LRERFE elements. This operation, to be covered by approved amendments to NSRs 526 and 662, will require (1) transfer of the TSF elements to the Building 3027 vault, (2) storage of no more than 20 elements (or stacks of plates containing less than 240 g ^{235}U) in the Building 3044 vault (in a single tier) at any time, and (3) no more than four elements (or stacks of plates) in work within the shop at any time.

Balance Area 220 (J. Bolinsky)

Operations in this Balance Area, which covers solid waste storage, were discussed with R. H. Winget, Jr., the Radiation Control Officer. They have had no problems in conforming with the existing NSR-626, but reminded us that they have no way of confirming the customer's estimate of the fissile content of waste drums.

A nondestructive system for assay of ^{233}U is presently being used for the waste drums that are generated at Building 3019. Unfortunately, ORNL does not have a system to permit nondestructive assay for other fissile materials. Quantities of ^{235}U and Pu in waste drums are estimated on the basis of losses in physical inventory.

Solid State Division

Reviewers: J. P. Nichols and J. H. Marable

Balance Area 85 (J. T. Howe)

This Balance Area, covering Solid State operations in Building 3025, had a fissile inventory of only 20 grams. On occasion some of these materials are transferred to the ORR, but would not contribute any nuclear safety hazard.

Operations Division

Reviewers: J. H. Marable and J. P. Nichols

Balance Area 20 (C. B. Gaither)

The vaults and pool storage for PCA, BSR, and ORR fuel elements were visited on December 21, 1972. The racks in the vaults appeared mechanically sound, the cadmium plates were securely fastened, and the elements were storedin an approved manner.

Building 3095 was also visited. This building reportedly stores 4625 grams of ^{235}U in enriched form and 16,000 of normal U. The contents of the shipping containers have not been verified.

Balance Area 25 (E. M. King)

There is less than 1 kg total of fissile material in this Balance Area, much of it in small samples containing only a few grams. Building 3026D and 3025 were visited on December 20, 1972, since these buildings contained most of the fissile material. There seemed to be little change from that reported last year.

Balance Area 26 (B. L. Corbett)

This area includes the vault storage and pool storage of new and spent HFIR fuel elements. The HFIR building was visited on December 20, 1972. Although large amounts of fissile material are involved, there is virtually no criticality hazard in normal operations.

Balance Area 311 (R. L. Newton)

The Liquid Waste Disposal system has been functioning consistently according to Standard Operating Procedures and samples have been diluted, with ^{238}U or ^{232}Th prior to disposal with the exceptions of small samples, usually of analytical waste, for which individual waivers or approvals have been granted.

Chemical Technology Division

Reviewers: F. T. Binford and R. E. Millspaugh

Balance Area 70 (R. E. Brooksbank)
Balance Area 65 (C. F. Keck)
Balance Area 80 (M. E. Whatley)
Balance Area 72 (E. D. Collins)

The Chemical Technology Division currently has 25 NSRs outstanding. Of these, six cover the approval of shipping casks of one kind or another; seven relate to operations in Building 3019; three relate to operations and storage in Building 4505, and the remaining nine concern miscellaneous operations and storage in Buildings 3508, 4507, 7920, and the storage garden and canal (3457).

Seven of these NSRs expire at the end of 1972, and it is our understanding from the Chemical Technology Radiation Control Officer that renewals are being requested. In some cases in Balance Area 70 (Building 3039), older NSR's will be covered by NSR-610 and will thus be allowed to expire.

The Committee visited Messrs. Keck, Ruch, Whatley, Ryon, Brooksbank, and Parrott of the Chemical Technology Division on January 11, 1973, for the purpose of reviewing their operations with respect to criticality safety. We found the physical operation to be in order, and the record keeping to be adequate with the possible exception of Balance Area 65. In our view the problem encountered there arises from the fact that this Balance Area serves a variety of different physical locations including Buildings 3508, 4507, 7920, 3457, and in some cases 3019. In addition, the area serves several different operations. As a result, particularly in view of the fact that the Balance Area code frequently is omitted from the NSRs, it is difficult to keep track of what material is where. Moreover, the regulation permitting the use of small quantities of fissile material without the necessity for an NSR further complicates the control problem. This is perhaps indicative of a problem which may exist elsewhere. We believe that the problem of controlling the inventory of fissile material from a safety standpoint should be handled on the basis of its physical location rather than on the basis of artificial balance area which may consist of widely separated locations. While the amount of material present in any location is carefully controlled by the NSR review itself, the breakdown of the auditing function by Balance Area is not very satisfactory.

(Editor's comment: The new SSNM Machine Accounting System, which began operation toward the end of year, is specifically intended to alleviate the type of problem described above. This new system will be reviewed and discussed at the next meeting of the Criticality Committee.)

Metals and Ceramics Division

Reviewers: J. W. Wachter and Reginald Gwin

Balance Area 50 (G. E.Angel)

There were approximately 13.6 kg of fissile material in this Balance Area (the Rolling Mill, Building 3012), of which about 2 kg ^{235}U was being actively worked on at the time of the review. This material was being handled in accordance with the applicable NSR-663, which is based upon the dryness of the material (H/X less than 2). The remaining material was in storage safes.

Two cases of poor nuclear safety practice were observed: Although careful account was being kept for most storage areas of the weight of the plastic bags used to contain the alloy plates, this was not true in the case of one safe. Painted signs on each shelf restricted the number of fuel elements rather than the masses of plastic and fissile material. On one shelf of this safe, individual fuel elements were wrapped in plastic bags so as to give a weight of about 2 g plastic up to 1 g ^{235}U, compared with the maximum of 60 g plastic/kg of ^{235}U approved by the NSR. Only 34 g of ^{235}U were involved, so that the shelf would have met the usual 200 g limitation for unlimited moderation, had this been requested. It is recommended that the NSR be modified to allow this limit for this particular safe storage repository.

It was also observed that file drawers used as fissile material repositories were used for other purposes as well. It is recommended that file cabinets used for fissile material be clearly marked "fissile" and be used exclusively for this purpose since the presence of other materials confuses the user, obscures the fissile material, and confounds the nuclear safety analysis.

Balance Area 54 (E. S. Bomar)

The material charged to this Balance Area was located in the Interim Plutonium Laboratory, which had 817 g Pu, 430 g ^{233}U, and 138 g ^{235}U. None of the material was being processed and the glove boxes were being used for storage. One box, clearly labeled as having a 250 g limit, was equally clearly marked as having a 280 g inventory. This apparent limit violation came about because of a verbal approval for the increased glove box limit for which no written approval had yet been issued. In view of the inactivity of the area, the increased limit would be appropriate on a temporary basis.

Balance Area 55 (V. R. Bullington)

The fissile material storage cage on the balcony of Room 106 was the only section of this Balance Area with a significant amount of fissile material. The 840 g ^{235}U in this cage was stored in a satisfactory manner.

Other laboratories in the Balance Area contained small amounts of material and were not visited during the audit. None of the Building 4500 rooms contained any plutonium, and only one location had as much as 1 g ^{233}U. The largest amount of ^{235}U in any room was 68 g.

Balance Area 57 (W. W. Proaps)

A total of 4814 g ^{235}U was found in this Balance Area (Ceramics Laboratory). Most of this material was stored in filing cabinets in an orderly fashion and with a good accounting system.

One table in the laboratory was designated as the receiving area where materials are unloaded from birdcages. To permit the breaking down of large incoming shipments, the limit for this area is 5 kg ^{235}U of dry materials. Since this table is near the water cooling coils of the furnaces and has sprinklers overhead, it would seem desirable to move this operation into a hood. It is recommended that Hood 4-16, which is in a convenient location and is provided with balance scales, be used for this operation.

Balance Area 58 (J. D. Sease)

The Alpha Facility of Building 4508 was relatively inactive, and most of the inventory of 4216 g ^{235}U, 59 g ^{233}U, and 1970 g Pu was in temporary storage within the hoods. The material was being handled in conformance with the applicable nuclear safety approvals.

Isotopes Division

Reviewers: D. W. Magnuson and H. F. Stringfield

Balance Area 01 (H. F. Stringfield)

Storage Vaults 3008-E and 3027 were visited and the actual inventory of Vault 3008-E, item by item, was verified. Only approved shipping containers, approved isotope cans, fuel plates, package samples are stored in these Vaults.

Balance Area 30 (D. R. Watkins)

The material transfer records and accounting procedures used for control of these special materials are adequate. No inspections of the hot cells or glove boxes were made. The small inventories of fissile materials preclude any criticality hazard and the isotopes of transplutonium elements are mainly those isotopes which have small thermal neutron cross sections.

Balance Area 33 (H. R. Gwinn)

The operations in this Balance Area are conducted under a 250-gram batch limit in the calutron. Records were examined for compliance. The bulk of their inventory which undergoes few changes consists of feed materials. These were stored in seven birdcages in their Storage Vault which is kept

in an orderly manner. Their other small sample storage areas were also inspected. New operations are planned under the same limits involving different isotopic compositions which have larger amounts of the nonfissile isotopes.

Balance Area 35 (H. L. Adair)

Several of the NSRs covering operations in this Balance Area will expire in December, 1972. New operations involve some of the same equipment used previously and updating will be accomplished during the revision. All dry operations are conducted under a 1 kg batch limit and Control Area limit of 3 kg total. Encapsulations are performed under a 200 g limit. Most of the target preparation work now centers around the transplutonium elements. Because of the small inventories and alpha hazards, the laboratory room where these operations were conducted was not visited. It should be emphasized that the isotopes being processed are those having small thermal neutron cross sections. The rolling mill glove box which contained a small sample storage area was inspected as well as the sample storage cabinet. It was recommended that some of the nonfissile materials be removed and stored elsewhere.

Health Physics Division

Reviewers: D. W. Magnuson and H. F. Stringfield

Balance Area 130 (A. D. Warden)

Less than 230 g of plutonium are charged to this area. This material is in the form of foil in threshold detector units throughout the Laboratory. There is no criticality hazard and no inspection was made.

Balance Area 131 (F. F. Haywood)

The fissile inventory outside the reactor consisted of three extra parts of the HPRR core total 10,867 g of ^{235}U, each in a separate section of a safe which remained locked during our visit with Mr. Thorngate. Since this inventory has not been used in recent years, it was recommended that it be returned to Storage Vault 3008-E with other spare fuel for this reactor.

Neutron Physics Division

Reviewers: D. W. Magnuson and H. F. Stringfield

Balance Area 102 (L. B. Holland)

The fissile inventory not contained in reactors consisted of unirradiated and irradiated fuel plates in dry storage, the former in a locked safe (combination not available during our visit) and the latter in a shielded concrete hole. These NSRs expire in December, 1972, and a renewal request will be submitted.

Reviewers: R. E. Millspaugh and F. T. Binford

Balance Area 101 (Hanover Weaver)

No NSRs are assigned to this area. Fifty-one grams of enriched U, ^{233}U, and ^{239}Pu are presently in this area; hence, no NSR is required. No change is foreseen.

Analytical Chemistry Division

Reviewers: R. E. Millspaugh and F. T. Binford

Balance Area 110 (Arnold Harrod)

Less than 200 grams of enriched U and Pu covered by NSR 545 are presently in the Analytical Chemistry laboratories. L. T. Corbin, acting in A. Harrod's absence, states that no change is foreseen.

Instrumentation and Controls Division

Balance Area 135 (W. P. Kinser)

There is no NSR for this area. There is some enriched U and Pu in the form of sources. This is much less than the 200 g minimum which would require an NSR.

Reactor Chemistry Division

Reviewers: R. Gwin and J. W. Wachter

Balance Area 160 (W. Carey)
Balance Area 165 (W. J. Martin)

The activities in the Reactor Chemistry Division were reviewed. Very little work was in progress and no need for most of the fissile material was foreseen. We suggested that materials not needed be removed where feasible.

Chemistry Division

Reviewers: R. Gwin and J. W. Wachter

Balance Area 120 (C. E. Haynes)
Balance Area 125 (B. H. Ketelle)

Each of these areas has a fissile inventory of less than 50 g. The mass, form, and projected uses of the materials are such that there is no significant potential that they may interact with fissile materials from other balance areas.

Physics Division

Reviewers: R. Gwin and J. W. Wachter

Balance Area 90 (M. F. Phillips)

The area has a current inventory of 70 g fissile material, most of which is stored in a locked repository at the end of Corridor G in Building 4500 North. This material either does not interact with material from other Balance Areas or is of such form and concentration that it is unlikely that these materials would increase appreciably the reactivity of other arrays of fissile material.

Reactor Division

Balance Area 172 (P. H. Harley)

The fissile materials listed for this area are stored in the MSRE drain tanks. No changes have been made since the last criticality review. No inspection was made.

GENERAL

SSNM Machine Accounting System

A general meeting was held to brief Control Area Supervisors, Balance Area Representatives, and Radiation Control Officers with respect to the new system that will account for nuclear materials by physical location. This meeting was followed by individual meetings with each Division that had the purpose of establishing all of the ORNL Control Areas. Operation of the new system began in October, 1972. At least several months of debugging operations will be required.

Statistics

A total of 48 Requests for Nuclear Safety Review (NSRs 624 through 672) were processed by the Committee in 1972. Virtually all of these were approved (with recommendations), but several were withdrawn by the requesters for further study. Approval (by memo) was given to extend expiration dates on several NSRs where no (or inconsequential) changes in operation were ancitipated.

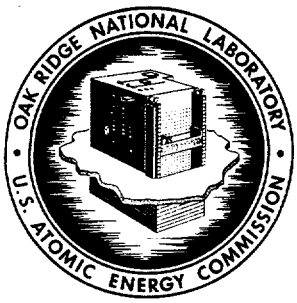
Jere P. Nichols

Jere P. Nichols, Chairman
Criticality Committee

JPN:bb

2354

DATE ISSUED: JUL 3 1972



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ORNL
CENTRAL FILES NUMBER
72 - 6 - 16

DATE: June 15, 1972

SUBJECT: 1971 Nuclear Safety Annual Review

TO: Alvin M. Weinberg; F. L. Culler

FROM: Criticality Committee

ABSTRACT

As of January, 1972, the Oak Ridge National Laboratory had an inventory of approximately 3000 kg of fissile material. All of the work areas having significant quantities of fissile materials were physically inspected by members of the Criticality Committee. In general, the work areas were found to be orderly and in conformance with previous recommendations of the Committee. In a few areas it was suggested that housekeeping, signs, or procedures should be modified to increase the safety of the operations.

1971 NUCLEAR SAFETY ANNUAL REVIEW

INTRODUCTION

The responsibilities of the ORNL Criticality Committee are as follows:

a. Has review and approval jurisdiction over operations which involve the handling, storage, transportation, and disposal of significant quantities of fissile materials.

b. Approves a Nuclear Safety Review Request form, UCN-5917, for the existence of each fissile control area if the quantity of fissile material to exist in the area exceeds the following:

   1. 200 g ^{235}U or ^{233}U or mixture thereof, but excluding the ^{235}U in items of natural or depleted uranium, or

   2. 200 g of the sum of the elements Pu, Np, Am, Cm, Bk, and Cf, or

   3. 5 g of the sum of the isotopes ^{236}Np, ^{242m}Am, ^{243}Cm, ^{245}Cm, ^{247}Cm, ^{249}Cf, and ^{251}Cf

c. Reviews annually any facility or location where there is on record fissile material equal to the amount stated in (b) above.

d. Approves any new program requiring more than the above listed amounts of fissile material before the material can be withdrawn from storage.

Critical assemblies in reactor cores are the responsibility of the Reactor Operations Review Committee. However, handling of fuel elements before and after their use in a reactor and criticality problems involving experiments inserted in a reactor are to be reviewed before operators or experimenters proceed with their plans.

Our policy in performing the annual review has been that an on-site inspection is required if it is likely that the Balance Area will be charged with significant quantities of fissile materials (including other isotopes of Pu and transplutonium isotopes) in the next year. Our definition of significant considers the minimum critical mass of the material and whether materials from a balance area are likely to interact with those of another.

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2. Familiarize ourselves with work areas and processes that utilize fissile materials.

3. Determine compliance with existing Nuclear Safety Reviews (NSRs).

4. Be on the lookout for potentially unsafe conditions that might arise from poor housekeeping, cumbersome policies, inadequate administrative procedures, lack of proper signs, warnings, and monitors, and possible oversights in the review-approval process.

5. Prepare a written report on the status of each Balance Area for inclusion in this annual report.

The following sections will comment on the results of the annual review (in March, 1972) by ORNL Divisions. The last section will summarize general work performed by the Committee in 1971.

The ORNL fissile inventory by Balance Area as of January 31, 1972, is presented in Table 1.

BALANCE AREA REVIEWS

Inspection Engineering Department

Reviewers: D. W. Magnuson and H. F. Stringfield

Balance Area 12 (O. J. Smith)

The fissile inventory consisted of a fuel plate which is a reference standard for nondestructive testing. There is limited work on small fissile samples usually of only a few grams.

Plant and Equipment Division

Reviewers: D. W. Magnuson and H. F. Stringfield

Balance Area 15 (Ross Jones)

The fissile inventory consisted of parts for the Tower Shielding Reactor which have been in storage for some time. Principal work expected is fabrication of shim control rods for reactors.

Balance Area 220 (J. Bolinsky)

The operations of the Solid Waste Disposal area were visited. Since each operation requires approval before execution or delivery to the area, there should not be any criticality problem.

Operations Division

Reviewers: H. F. Stringfield and D. W. Magnuson

Balance Area 20 (C. B. Gaither and R. K. Branum)

The fuel elements for the ORR, BSR, and PCA both irradiated and unirradiated comprise the fissile inventory for Balance Area 20. Visual aids

OAK RIDGE NATIONAL LABORATORY
FISSILE MATERIAL BALANCE AS OF JANUARY 31, 1972

(Weights in Grams)

Table 1

Balance Area	Balance Area Representative	Enriched U >75%		Enriched U <75%		Uranium-233		Plutonium		Plutonium-238	
		U	^{235}U	U	^{235}U	U	^{233}U	Pu	$^{239,241}Pu$	Pu	^{238}Pu
01	H. F. Stringfield	258,131	240,482	28,554	3,910	210	208	13,130	10,421	468.3	375.2
12	O. J. Smith	14	13								
15	H. G. James	1,229	1,145								
20	C. B. Gaither	61,739	54,291								
25	E. M. King	1,220	1,061	476	58	203	43	184	170		
26	B. L. Corbett	535,240	491,166	85	2						
30	D. R Watkins	96	90					10	10	1,312.7	1,158.4
33	H. R Gwinn	5,822	5,544	3,323	1,596	369	367	1,652	1,084		
35	F. R. O'Donnell	1,995	1,874	7	1	131	129	328	314	17.2	13.5
50	G. E. Angel	3,620	3,374								
54	E. S. Bomar	258	241	180	36	138	137	958	846		
55	V. R. Bullington	6,275	5,863	10,991	1,258	1	1	58	52		
57	W. W. Proaps	2,860	2,665	9,137	842						
58	J. D. Sease	5,077	4,735	15	1	11	10	1,892	1,721		
65	C. F. Keck	1,429	1,336	10,999	818	85	84	1,437	1,313		
70	R. E. Brooksbank	1,050,856	803,168	377	66	2,158,112	1,182,848	5,598	4,939		
72	L. J. King							11	*		
80	M. E. Whatley	1,242	1,155	217,155	2,603						
85	J. T. Howe	20	20					23	23		
90	M. F. Phillips	40	37			17	17	25	16		
101	Hanover Weaver	40	40			6	6	9	9		
102	L. B. Holland	14,967	13,949					6	6		
110	A. L. Harrod	32	30			1	1	130	122		
120	B. H. Ketelle							14	13		
125	C. E. Haynes	2	2	2	*			43	38	0.9	0.7
130	H. H. Abee							227	225	0.7	0.6
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172	P. H. Harley	1	1	2,684	863	35,387	31,283	718	646		
	TOTALS	2,068,233	1,740,374	592,473	17,709	2,194,781	1,215,242	26,955	22,456	1,799.8	1,548.4

*Denotes less than reportable quantity.

or charts showing the present location of each fuel element in the approved storage racks were located near each reactor. The two dry storage racks were located near each reactor. The two dry storage vaults were also inspected. Approval for the arrangement in the Vault of Building 3042 (NSR 519) was granted on the basis of a reduced number of rows of elements to be stored. The covers to the rows of pigeonholes are sturdy and adequate to prevent use of the alternate rows.

Balance Area 25 (E. M. King)

The fissile inventory of Balance Area 25 is impossible to verify in the strictest sense; however, several areas were visited and verbal identifications were made of the bulk of the fissile material which was in an irradiated HFIR fuel element. The canal in Building 3025 contained several small samples of irradiated mixed oxide. These were unloaded here because the normally used and approved dry storage holes were not long enough to accommodate these samples involving less than 200 g of fissile material. The unrestricted use of the canal for storage of less than 200 g of fissile material is now or will be approved by letter as an addendum to NSR 550.

Balance Area 26 (B. L. Corbett)

The HFIR Storage Vault has 45 unirradiated fuel elements, all stored in a planar array. Each of the boxes, which may contain two outer or six inner elements had the required 2 x 4 bumpers which increased the separations as recommended. The contents of one box were checked against the chart in the office. This chart, showing the location of each element, was up to date, including elements recently transferred to and from the Oak Ridge Critical Facility. The pool storage, capable of storing four in one array and fourteen in another, contained ten complete elements as indicated.

The HFIR reactor site is accessible without restriction during off-shift hours and it may be desirable to improve the security of the storage vault which now contains ~400 kg of ^{235}U. The metal grill door and barrier type wall could be easily penetrated.

Balance Area 85 (J. Howe)

The fissile inventory (43 g) is contained in special samples used as neutron filters in research. Increased use of fissile material by an order of magnitude is not predicted.

Balance Area 311 (R. L. Newton and E. J. Witkowski)

The Liquid Waste Disposal system has been functioning consistently according to Standard Operating Procedures and samples have been diluted, with ^{238}U or ^{232}Th prior to disposal with the exceptions of small samples, usually of analytical waste, for which individual waivers or approvals have been granted. It was emphasized that the

Material Transfer Form, for convenience, should have the approval for discard and dilution scheme as well as the amounts discarded. In other words, the "Disposal Form" should be essentially self-explanatory and a single form.

Chemical Technology Division

Reviewers: J. W. Wachter and J. H. Marable

Balance Area 65 (C. F. Keck)

Most of the fissile material of this Balance Area was stored in the wells of the Hot Garden (~2 kg ^{235}U and 411 g Pu). The remaining material was being used in batches of < 350 g at widely separated sites.

Building 3508 contained two batches of material: about 350 g ^{239}Pu and ^{233}U in two glove boxes in Room 5 and about 240 g ^{239}Pu in Room 2. Both batches were being handled in a safe manner.

Two separate operations at Building 7920 involved, together, about 300 g of ^{239}Pu being handled in several glove boxes. The material was being processed in accordance with current NSRs.

Less than 350 g of ^{235}U was being handled in a nuclearly safe manner in several laboratories of 4500.

Balance Area 70 (R. E. Brooksbank)

At the time of this review, approximately 10 kg of ^{233}U was being processed under the LWBR program with all other fissile material in storage. In its review, the subcommittee visited the new oxide line, now almost complete. In this initial phase of actual processing, production appears to be going smoothly with no changes affecting nuclear safety apart from necessary revisions of procedure sheets.

The 3100 storage vault was found to conform to standard nuclear safety practice. The area contained several kilograms of ^{233}U, mostly in Rocky Flats birdcages. This vault is to be torn down and replaced with a new storage facility, and the present material moved to a cell during this construction. Since the material was mostly in birdcages, this procedure should not pose any nuclear safety problems.

The area contained slightly over one long ton of ^{233}U, 800 kg of which was held in the 9 tanks of the P. T. Storage Area. An additional 262 kg was stored in the oxide dry storage wells. Five kg was in the 3597 Storage. Some 800 kg of ^{235}U and 100 kg of ^{233}U were located in the TRUST Storage Tank.

Operations were found to conform to good nuclear safety practice, and the attitude toward criticality control was good.

Balance Area 72 (L. J. King)

This area contained less than 1 g of SS isotopes and was not visited. However, increasing amounts of ^{245}Cm and ^{247}Cm are expected in this area, and a Nuclear Safety Request has been submitted to the Committee.

Balance Area 80 (M. E. Whatley)

All the fissile material in this area was located in a locked storage area which was further partitioned into separate areas for each user. The material, comprising 2.6 kg ^{235}U as 1.2% enriched fuel rods and 1.1 kg ^{235}U of high assay, was being stored and handled in accordance with NSR approvals.

Metals and Ceramics Division

Reviewers: F. T. Binford and J. P. Nichols

Balance Area 50 (G. E. Angel)

There is presently no active work with fissile material in this balance area (the rolling mill, Building 3012). Material is stored in conformance with NSRs 522 and 525. Plans are being made to transfer much of the current inventory of 3373 g of ^{235}U to the SSNM vault.

Balance Area 54 (E. S. Bomar)

All materials associated with this balance area are contained within the Interim Plutonium Laboratory, Rooms 136 and 137 of Building 4508. Work presently involves preparing and studying the properties of oxides and nitrides of plutonium, enriched uranium, and ^{233}U. The operations were orderly and in conformance with the applicable NSR 513, which limits the fissile mass to no more than 250 g in each box or suite of boxes.

Balance Area 55 (V. R. Bullington)

This balance area consists of the fissile material storage cage on the balcony of Room 106 in Building 4508. Most of the storage cabinets are currently empty. The storage was orderly and in conformance with the applicable NSRs.

A major activity involving material from this balance area - the uranium oxide production by J. M. Leitnaker - has been completed and all fissile material has been removed from the oxide production equipment in Room 241 of Building 4508.

The current inventory in other work areas involving material from this balance area - including Rooms 120, 274, and 257 - is all less than 100 g of fissile material.

Balance Area 57 (W. W. Proaps)

Material in this balance area is processed and stored within the Ceramics Laboratory, Room 159, of Building 4508. The processing operations, labeling, and storage were in conformance with the applicable NSRs.

Three of the NSRs (Nos. 461, 563, and 570) covering this work and storage area are due to expire soon. Since there are no anticipated needs for revision of the requirements or procedures, it is recommended that the expiration date of these NSRs be extended through February, 1974.

Balance Area 58 (J. D. Sease)

This balance area covers operations within the Fuel Cycle Alpha Facility, Room 265 of Building 4508. Operations and storage were in conformance with the applicable NSRs 576 and 585.

Reactor Chemistry Division

Reviewers: J. P. Nichols and F. T. Binford

Balance Area 160 (Woodrow Carey)

This balance area, which covers miscellaneous laboratory work with fissile materials in the Reactor Chemistry Division, has a fissile inventory of 167 g. Most of the fissile material is in storage and is very unlikely to interact with material from other balance areas.

Balance Area 165 (W. W. Martin)

Most of the fissile material in this balance area is in the form of low enrichment irradiated and unirradiated fuel specimens in the form of slugs or rods. The largest quantity (5.6 kg of ^{235}U as 1.8% enriched UO_2 in Zircalloy rods) is stored in drums in the third floor cage area in accord with NSR 480. Smaller quantities of material are stored in approved containers in Rooms 103, 124, and 125 (NSR 480); Hot Cells and Storage Holes (NSRs 470, 573, and 574); and a fireproof cabinet in Room 116 (NSR 471). Small quantities of irradiated fissile material as about 3.5% enriched fuel rods are stored within two shipping casks in the high bay area.

Several of the applicable NSRs have expired recently or will expire in the near future. Because of the low activity in the building, Mr. Martin has submitted another Request for Nuclear Safety Review that will combine all of the previous NSRs and establish control limits for all of the operations and storage areas in Building 4501.

Chemistry Division

Reviewers: J. P. Nichols and F. T. Binford

Balance Areas 120 and 125 (C. E. Haynes and B. H. Ketelle)

Each of these areas has a fissile inventory of less than 50 g. The mass, form, and projected uses of the materials are such that there is no

significant potential that they may interact with fissile materials from other balance areas.

Physics Division

Reviewers: J. P. Nichols and F. T. Binford

Balance Area 90 (M. F. Phillips)

The area has a current inventory of 70 g of fissile material, most of which is stored in a locked repository at the end of Corridor G in Building 4500 North. This material either does not interact with material from other balance areas or is of such form and concentration that it is unlikely that these materials would increase appreciably the reactivity of other arrays of fissile material.

Neutron Physics Division

Reviewers: J. H. Marable and J. W. Wachter

Balance Area 101 (H. Weaver)

There are no NSR's assigned to this balance area. There is about 50 g total of Pu, ^{233}U, and ^{235}U (highly enriched), and hence no NSR is required. No change is foreseen.

Reviewers: R. E. Millspaugh and R. Gwin

Balance Area 102 (L. B. Holland)

The Tower Shielding Facility presently has two NSRs in effect:

NSR 551 covers the storage of nine TSR-II spherically shaped cover plates containing a total of 524 g of ^{235}U stored in a security cabinet.

NSR 627 covers the transporting of birdcages by truck between the ORNL SS Accountability vault and DOSAR. A maximum of ten birdcages, each containing 18.6 kg of ^{235}U as U-Mo alloy, is permitted.

Analytical Chemistry Division

Reviewers: J. H. Marable and J. W. Wachter

Balance Area 110 (A. L. Harrod)

There is a small amount (less than the 200 g minimum) of material (enriched U and Pu) covered by NSR 545. A. L. Harrod, balance representative states that no change is foreseen.

Instrumentation and Controls Division

Reviewers: J. H. Marable and J. W. Wachter

Balance Area 135 (J. Guarneri)

There is no NSR for this area. There is some enriched U and Pu in the form of sources. This is much less than the 200 g minimum which would require an NSR. This situation is fairly static and no change is expected according to balance area representative Joe Guarneri.

Health Physics Division

Reviewers: R. E. Millspaugh and R. Gwin

Balance Area 130 (H. H. Abee)

Less than 230 g of plutonium are charged to this area. This material is in the form of foil in threshold detector units throughout the Laboratory. There is no criticality hazard and no inspection was made.

Balance Area 131 (F. F. Haywood)

Most of the approximately 115 kg of fissile material charged to DOSAR is in the HPRR. The remainder, about 10.9 kg of ^{235}U plus less than 100 g of ^{239}Pu, are stored in a safe in Building 7710. The safe was found to be in order.

In checking NSR 625 it was noted that a total quantity of fissile isotopes was listed as 10,863 g of ^{235}U. Under the recommendations and provisions smaller quantities of less than 500 g per shelf of ^{239}Pu and ^{237}Np are permitted on the three lower shelves. It is felt that this 1500-gram total should be included in the total quantity value of the NSR.

Reactor Division

Reviewers: R. E. Millspaugh and R. Gwin

Balance Area 172 (P. H. Harley)

According to Mr. Harley, the fissile materials listed for this area are stored in the MSRE drain tanks. No changes have been made since the last criticality review. No inspection was made.

Isotopes Division

Reviewers: R. Gwin and R. E. Millspaugh

Balance Area 01 (H. F. Stringfield)

The method of determining the storage of fissile materials in the vaults (Buildings 3027, 3008, and 3506) is undergoing revision at this time. A request is being (or has been) made to the Criticality Committee which bases the storage of fissile materials on the "definition" of a criticality unit. In the meantime the storage of fissile materials in the vaults of Building 3008 and 3027 seems to continue on extensions of NSRs 313 and 314. The housekeeping in this Balance Area is excellent.

Balance Area 30 (D. R. Watkins)

At present operations covered by NSRs in Balance Area 30 seem to be mostly concerned with ^{238}Pu. It is planned to replace NSRs 593, 594, 603, and 617 with one NSR to cover the operations in Building 3038.

Balance Area 35 (F. R. O'Donnell)

The review of Balance Area 35, with F. R. O'Donnell, brought up one point concerning the literal interpretation of an NSR. In one coating operation, copper was specified in the operation and the question was whether some other metal could be used and still conform to the NSR. The response of the subcommittee was negative, and it was suggested that an addendum to the NSR be obtained. It seems that regular contact between those persons responsible for operations with fissile materials and an individual knowledgeable in acceptable operations with these materials would be valuable.

Balance Area 33 (H. R. Gwinn)

Balance Area 33 was reviewed with H. R. Gwinn and F. M. Scheitlin. Nuclear Safety Review Request 529 is not required and can be allowed to expire or cancelled now. A new storage area is now in use and is covered by NSR 602. It was pointed out to the subcommittee that some storage of fissile material in an Air Force safe and birdcages was in an area which might not be covered by an NSR. The subcommittee suggested that the material be moved to an area covered by an NSR or that an NSR covering the particular area be obtained.

NSRs 280, 512, and 620 were reviewed with R. D. Seagren.

GENERAL

Safe Mass Limits for Actinide Isotopes

Fissile isotopes other than ^{233}U, ^{235}U, and ^{239}Pu are beginning to be accumulated in facilities of the Chemical Technology and Isotopes

Divisions. Estimates were made of the safe masses of these materials to provide interim guidance for nuclear criticality safety evaluations (see Appendix). In the near future, we plan to update the ORNL Health Physics Procedures Manual with recommended mass limits of all fissionable isotopes (including ^{238}Pu and ^{244}Cm). See Appendix.

Statistics

A total of 117 Requests for Nuclear Safety Review (NSRs 556 through 622)were processed by the Committee in 1971. Virtually all of these were approved (with recommendations), but several were withdrawn by the requesters for further study. Five meetings of the full Committee were held.

Jere P. Nichols bb

Jere P. Nichols, Chairman
Criticality Committee

JPN:bb

APPENDIX

(D. W. Magnuson)

Estimated Safe Mass Limits for Actinide Isotopes

The minimum critical mass limits for several actinide isotopes have been calculated using a very simple technique[1] and have been published with recommended subcritical limits.[2] The method is dependent on 2200 m/sec capture and fission cross sections and the value of ν for the isotope, the hydrogen absorption cross section, the neutron age-to-thermal, and the neutron diffusion length.

Since the values of these cross sections are subject to revision, revised estimates of the minimum critical masses were made with different cross sections. In the calculations reported here the neutron age-to-thermal energy[3] was 26.5 cm^2 and the extrapolation distance including water reflector savings was 5.9 cm.[4] The values of these parameters were not given for the previous estimates and were probably slightly different. The comparison of all of these calculations of the minimum critical masses is given in Table 1 with new subcritical limits established by dividing by 4.6, the typical factor of 2.3 plus an additional factor of 2 because of the large uncertainties in cross sections. The use of the two-group buckling theory for small systems is questionable and is another reason for having a larger safety factor than usual.

The estimates given here for the minimum critical masses do not include the effects of resonance absorption and in general this effect gives rise to increased minimum values. These estimates are also for essentially pure isotopes. In general, the even isotopes for the even atomic numbered elements have small thermal fission cross sections and the presence of such isotopes has been ignored. Similar to isotopic dilution of ^{235}U with ^{238}U, the increase in critical mass can be large for small percentages of the fissile isotope.

It is believed that reliable cross-section data must be obtained on all actinide isotopes which will be present in actinide solutions before more accurate criticality parameters can be calculated.

Minimum Critical Mass Estimates and Subcritical Limits for Fissile Isotopes.

Isotope	Value of ν	Experimental	Calculated by Clark		Calculated by This Report						Recommended Subcritical Limit (g)	
											Ref. 2	This Work
Cross Section Reference		5	2	2	6	7	8	9	2	8		
^{233}U	2.482[a]	600			479							250.0
^{235}U	2.432[a]	800			663							350.0
^{239}Pu	2.874[a]	500			431							200.0
^{241}Pu	2.89[b]					420		289				125.0
^{242m}Am	3.18[c]		23	21.2		36.8					10	5.0
^{243}Cm	3.28[c]		213	227		292					150	50.0
^{245}Cm	3.30[c]		42	38.6		49.7	41.3	58.3	19.8[d]		25	4.3
^{247}Cm	3.31[c]		159	150		191	2720	1890			120	32.0
^{249}Cf	3.70[c]		32	30.8		16.9[e]	14.7			12.8[f]	20	2.8
^{251}Cf	4.48[c]		10	9.7		12.7	6.1	26.6			3	1.0
^{253}Cf								10.5[g]				2.0

a. The value of ν was taken from Ref. 10.
b. The value of ν was assumed to be 2.89, the value obtained from ^{239}Pu by the method described in Ref. 2.
c. The value of ν was taken from Ref. 2.
d. The value of ν was assumed to be 3.83 from Ref. 11.
e. The value of ν was assumed to be 4.46, the value obtained from ^{251}Cf by the method described in Ref. 2.
f. The value of ν was assumed to be 4.60 from Ref. 11.
g. The value of ν was assumed to be 4.50, the value obtained from ^{251}Cf by the method described in Ref. 2.

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